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## METEOROLOGY.

### THE INTERNATIONAL WEATHER SERVICE.

Under this title the "*Popular Science Monthly*" for January opens with an article by Prof. T. B. Maury. The subject discussed is one of great and general interest, affecting so intimately all classes of society, and bearing upon so many of the most popular questions of the day, that we present an epitome of the chief conclusions reached by this writer. Introducing the subject, he says:

"The exploration of the vast body of water which surrounds the land-masses of the globe has been, since the 16th century, rapidly prosecuted. Its configuration has been determined, its tides weighed, its gulf-streams and counter-currents gauged, and even its abyssal depths sounded and surveyed, until we can now hardly speak, save by poetic license, of "the dark, unfathomed caves of ocean." But the exploration of that other and almost boundless ocean of air which envelops the whole earth and whose winds sweep its surface, swaying the waters of the sea and affecting every form of terrestrial life, has progressed but slowly. The upper atmosphere is pierced by but few of the earth's mountain-peaks upon which meteorological stations can be efficiently maintained, while the spasmodic attempts at aëronautic investigation of the cloud-land, daring as they have been, have realized less knowledge of its currents than that which Columbus in his voyages of discovery acquired of the circulation of the equatorial waters. Even in the lower atmospheric strata, the different national bands of observers have been widely separated—here and there an ocean unsentineled rolling between them—so that their

collated reports conveyed no clearly connected account of the trans-continental movements of air; and it is to-day disputed by some that North American storms cross the Atlantic to Western Europe. But, worse than all else, the observations taken by the most painstaking and indefatigable observers were, until recently, systematically vitiated, not only by a lack of uniformity in the methods, but by the more fatal lack of uniformity in the hours of observation. What would be thought of a little army confronting immense odds, some of whose regiments had one plan of battle and some another, some asleep when others were engaged, but none acting simultaneously? Yet such is a fair representation of the world's observational force which was expected to attack the great problems of meteorology, as it was until less than a decade ago.

"In 1870 the United States entered the field of weather-research; and, for the first time in the history of meteorology, there was then established a broad system of simultaneous observations and simultaneous reports of the weather. These reports were immediately worked up and graphically embodied in the simultaneous weather-maps, issued thrice daily from the office of the Chief Signal Officer, U. S. A., General Albert J. Myer, whose original and announced plan was to observe the weather over the whole country "*at the same moment of actual* (not local) *time*," as was stated on every weather map. This conception aimed at the rescue of meteorological researches from that disorder and disconnectedness which had always characterized the observational work. The prime object was to gain a daily *conspectus* of the atmosphere over the country as it *actually* was, and as it would be seen if a *photographic* view of it, so to speak, could be taken. The simultaneous method, when announced, seemed so natural and simple that one might have wondered that any other was ever attempted. Observations called "synchronous" had been, indeed, before this time, energetically made in several countries; but the term "synchronous" was used to signify that every observer read off his instruments at given hours of his own *local* time, and not at the same moment of physical time. Etymologically there might be little or no difference between "synchronous" and "simultaneous," but, for all the purposes of atmospheric investigations over a vast territory like that of the United States, the practical difference was by no means insignificant. When observers, who on the old "synchronous" method reported the weather status each at the same hour of local time, were separated by hundreds of miles, their reports failed to represent the actual fluctuations of the atmosphere and the true bearings of its cyclonic and anti-cyclonic movements; so that, when the meteorologist came to compare and chart the combined data, they yielded necessarily a distorted or untrue picture of the ever restless aërial ocean. On the other hand, in the "*simultaneous*" method, since all the observers over the wide field of the research read their instruments at one and the same moment (7 A. M. Washington mean time), their reports, when charted, give a true and life-like representation of the physical phenomena as they actually coexisted and conspired. As on the screen of the artist's camera the sun instantly paints the true image of the human face before its expression can be

changed, so does the process of simultaneous observation seize and secure all the elements necessary to delineate the current physical features and conditions of the atmosphere, as existing at a *fixed* moment, before they can have time to undergo change. Simple as this expedient is, it is evidently the key to all effective research in a gaseous ocean whose currents and waves are ceaselessly rolling and rapidly altering their geographical bearings, even while the sun is quickly passing from one meridian to another. Were all the weather observers of the world to read off their instruments, as it were, by a given tick of one clock, their collective data would furnish materials for the most exact delineations of the complex atmospheric machinery which it is possible to obtain."

Such is the account given of the new method of "SIMULTANEOUS OBSERVATIONS," the importance of which, for all purposes of weather-study, and weather-prediction can hardly be over-estimated. By the old Smithsonian method of observations and by that of Professor Espy also, all the observers read their instruments, not at the same moment of actual time, but at that of *local* time: they could not, therefore, render simultaneous reports. And, as Prof. Maury says, "a weather map based on non-simultaneous reports, instead of faithfully mirroring the sky overhanging a continent, necessarily gives it rather a *wry* face."

### ORIGIN OF THE WORLD-WIDE SYSTEM.

Coming now to the history of the International Weather Service, which is, strictly speaking, an extension of the United States weather system to the globe, the writer proceeds:

"In September, 1873, the International Meteorological Congress was convened at Vienna, to consider all the graver questions that were then agitating public and private investigators as to the progress of weather science. The Congress was composed of official representatives, charged with the meteorological duties pertaining to the researches of their respective governments. It was then proposed by the representative of the United States, General Myer, that '*it is desirable, with a view to their exchange, that at least one uniform observation, of such character as to be suited for the preparation of synoptic charts, be taken and recorded daily and simultaneously, at as many stations as practicable throughout the world.*' This proposition was unanimously concurred in, and its hearty adoption by the Congress, the members of which virtually legislated for the nations they represented, at once secured the extension of the American 'simultaneous' system (as inaugurated in 1870 for the United States) to the entire field of weather investigation then covered or yet to be covered by the observers of all the nations. Soon after the adoption of this proposition at Vienna, by the courteous coöperation of scientific men and the chiefs of meteorological weather bureaus of the different countries, records of uniform observations, taken daily and simultaneously with the observations taken over the United States and adjacent islands, were commenced, and since then have been exchanged in semi-monthly communications. These reports, steadily increasing, now cover the combined territorial extent of

Algiers, Australasia, Austria, Belgium, Central America, China, Denmark, France, Germany, Great Britain, Greece, Greenland, Iceland, India, Italy, Japan, Mexico, Morocco, the Netherlands, Norway, Portugal, Russia, Spain, Sweden, Switzerland, Tunis, Turkey, British North America, the United States, the Azores, Malta, Mauritius, the Sandwich Islands, South Africa, South America, and the West Indies, so far as they have been put under meteorological observation. On July 1, 1875, the daily issue of a printed bulletin, exhibiting these international simultaneous reports, was commenced at the Army Signal Office in Washington, and has since been maintained. A copy of this *International Bulletin* is furnished each coöperating observer. This publication combines, for the first time of which we have any record, the joint labors of the nations in a research of this kind for their mutual benefit. As the network of coöperating stations already spreads over so vast a proportion of the land-surface of the globe, there is needed only the more general coöperation of the naval and merchant fleets of the world to supply ample data for a comprehensive study of the atmosphere as a unit. This need is now growingly appreciated, and nine series of marine reports, each containing the simultaneous observations of a number of sea-going vessels, have been added to supplement the similar reports contributed by the land observers, swelling the total observational force to 500 laborers. The harvest of physical data already garnered by this force, and daily increasing, will be invaluable for all future weather investigations. As the Committee of the Scottish Meteorological Society recently said, 'this truly cosmopolitan work, which the United States are alone in a position to undertake, thanks to the liberality and enterprise of their government, will bring before us month by month the general circulation of the earth's atmosphere, and raise, if it does not satisfy, many inquiries lying at the very root of meteorology, and intimately affecting those atmospheric changes which meteorologists have been recording.'"

This great scheme had been, long before the Vienna Congress was convened, revolved by General Myer, who had broached it early in 1870, and repeatedly alluded to it in his subsequent official reports, as an object he was laboring to accomplish by connecting all weather bureaus "in a grand chain of interchanged international reports, destined with a higher civilization to bind together the signal-services of the world."

But the necessity for world-wide weather observations arises from the world-wide movements of the great aërial meteors, and from the intensity with which they act. This necessity is thus pointed out:

"The storms generated over the sea often push with resistless energy against the loftiest mountain walls, and, surmounting their acclivities, press on as if they had felt no retardation, to sweep across an entire continent, and then, untired, to take a fresh start on a long ocean voyage. In a rigid examination of the Signal Service data for a period of twenty-six months, twenty-eight storm-centers, it was found by Prof. Loomis, traveled eastward across the Rocky Mountains and reached the Mississippi Valley in unimpaired vigor, having scaled that imposing barrier,

10,000 feet high, as easily as the steamship on its rapid course overrides a wave. In discussing the two cyclones which visited the Bay of Bengal in October, 1876, Mr. Elliott, Meteorological Reporter to the Government of Bengal, incidentally gives us some idea of the cyclopean forces which are developed by such storms. The average 'daily evaporation,' registered by the Bengal instruments, in October, is '.2 inches.' The amount of heat absorbed by the conversion of this amount of water daily over so large an area as the Bay of Bengal is enormous. 'Roughly estimated,' says Mr. Elliott, 'it is equal to the continuous working power of 800,000 steam engines of 1,000 horse-power.' A simple calculation will show that it suffices to raise aloft over 45,000 cubic feet of water in twenty-four hours from *every square mile* of the bosom of the bay, and transport it to the clouds which overhang it.

"Phenomena such as we have just glanced at, by their immensity and by the intensity of the forces which resistlessly propel them across seas and continents, will forever defy adequate investigation, save by an army of observers, acting simultaneously, both on the ocean and on the land, whose outposts stretch from the rising to the setting sun, and from the equator to the polar circle. For, as another has so forcibly and felicitously said, 'the atmosphere, unlike the ocean, is undivided and uninterrupted, and every change of state, in any part of its expanse, sends forth a pulsation of energy which is speedily felt far and wide.' If the oracles of Him by whom are all things declare that he spreads 'the cloud of dew in the heat of harvest,' who 'gathereth the winds in his fists,' and once hushed the roar of the Galilean tempest, well may these wonders, ever fresh from his hand, enlist the earnest and inspiring study and observation of intelligent men everywhere."

### THE WEATHER CHART OF A HEMISPHERE.

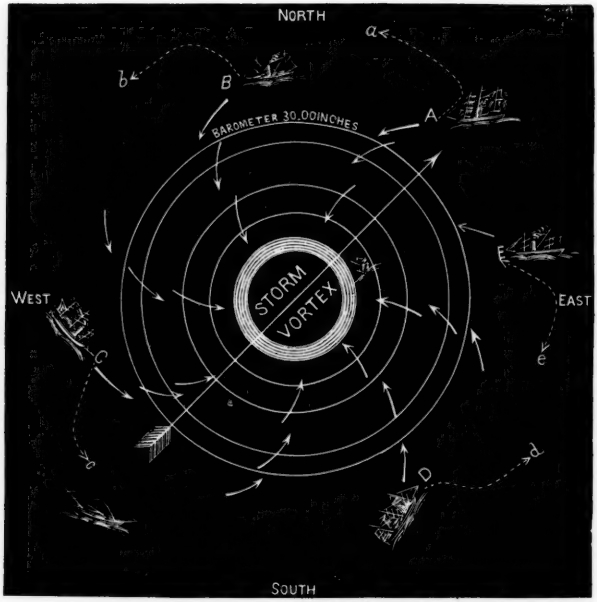
In the technical execution of this purely pioneer work, the first step was the construction of a daily weather map, embodying, in graphic form, all the weather observations "taken simultaneously" in the Northern Hemisphere. On the 1st of July, 1878, the Signal Service at Washington began the regular publication of a *Daily International Weather Map*, based upon the data of same date compiled in the daily published *International Bulletin*. Both of these publications are sent, without charge, to every observer who engages to take the daily simultaneous observations. Such a chart is without a precedent in the history of scientific investigation. As Prof. M. says, "it illustrates the coöperation, for a single purpose, of the civilized powers of the globe north of the equator, and brings the atmospheric phenomena over the whole field of the research, and in their true relations to each other, within the easy comprehension of the student's eye. As these charts in successive order are spread out day after day, the investigator has before him a vivid *panorama* of the physical forces in pictured action, so that he can readily trace their mutual dependence and interaction in the normal working of the ponderous, yet beautiful, atmospheric machinery."

XUM

The *International Weather Map* serves in meteorological research as Mercator's Projection (by which the earth's entire surface was presented in a single picture) did and does in geographical exploration. It offers the meteorologist every day a *bird's-eye* view of the aërial ocean as it was at the fixed moment of time when all the observations embodied in it were taken over the globe.

THE PRACTICAL UTILITIES OF THE WORK

are numerous and varied. "One of the first practical applications of the international observations," says Prof. Maury, "will be realized in the elucidation and correction of the '*law of storms*,' and of the rules for the extrication of ships at sea from the storm-vortex. In the domain of nautical meteorology, this law and its applications to the handling of ships on the outer circles of revolving gales, is especially yet to be sifted in the light of the most exact *simultaneous* observations. The international weather charts, illustrating the exacter forms of marine storms, show us that they assume very eccentric shapes, and consequently develop variant wind systems. On the liquid expanse of the stormy North Atlantic, crowded with the steamers and sailing-ships of all nations, there exists the finest field for this




MANŒUVRING SHIPS ON THE EXTERIOR OF A CYCLONE.

The dotted lines, *Aa*, *Bb*, *Cc*, *Dd*, and *Ee*, show the paths of *escape* from dangerous positions; the large arrow, the storm's progressive direction; the small arrows, the cyclonic winds.

investigation to be found on the globe. When these vessels become "floating observatories," rendering up accounts of their daily simultaneous weather experience, it will be comparatively an easy matter to set forever at rest the yet disputed questions of the phenomena of cyclones, and to formulate rules for manœuvring ships so as to elude their crushing forces."

WESTERN METEOROLOGY.

Another application, more immediately interesting those living in the western and interior States of the Union, is thus stated:

"As we have already seen, so far as critical examination has been made of the Signal Service weather maps, more than one cyclone from the Pacific coast every month, on an average, overleaps the Rocky Mountains and travels eastward, reaching the Mississippi Valley and the Lakes, with its original (perhaps ocean-born) strength. The ocean is preëminently the birthplace and habitat of storms. Thence, when fully formed and densely stored with aqueous vapor—the fuel of the cyclonic engine—they assail the land-masses of the earth, and traverse them, unless, *in transitu*, they perish for want of water and return to their native element. This is no less true of the great ocean that washes our western shores, notwithstanding its name, than of the 'stormy Atlantic.' Uncomfortably near as the West Indian hurricanes approach our Atlantic seaboard, they affect but comparatively a small strip of the eastern half of the United States, and often give us a wide berth. But the storms which invade our Pacific seaboard, from southern California to the mouth of the Columbia River, exert or expend their full force within the national limits, and frequently cut their broad swaths entirely across the country. The golden key, therefore, to our continental meteorology is the adequate knowledge of the barometric depressions and associate 'waves of high pressure' which roll over the continent from the westward, and, in their progress, dominate the weather to the north of the thirty-fifth parallel."

"Off the California coast there exists, throughout the year, a permanent area or wave of high atmospheric pressure, or a vast "anti-cyclone"—the diameter of which is something like one thousand miles. The barometer in this area reads 30.20 inches (see chart, p. 309). From its northern and western slopes, westerly and northwesterly wind belts extend in an easterly direction across the Coast and Rocky Mountain ranges. The immense stationary anti-cyclone, from which flows off this broad belt of westerly winds, is probably due to the continental barrier arresting and accumulating the perennial equatorial current from the central zone of the Pacific Ocean; and has its counterpart in the similar area of high pressure lying in the Atlantic, off the coast of Spain and South of the Azores. The great "*highway*," therefore, along which the chief atmospheric currents move and introduce on our continent the storm-controlling and weather producing influences, begins on the Pacific coast and traverses the country from west to east. As the Atlantic dominates the weather of Europe lying on its eastern shores, so in the Pacific Ocean is the cyclopean workshop of the atmosphere, in which are produced and

whence are sent forth the meteors that perpetually travel over North America, and substantially mold its climate and weather. To cover the North Pacific, therefore, with a network of "floating observatories," contributing their "simultaneous weather reports" to the Signal Service Bureau, is one of the grand desiderata of American Meteorology. A ship at sea is one of the best of stations for a simultaneous meteorological system. The value of its records is enhanced by the considerable change of the ship's location occurring once every hour; and the law of self-interest at least should compel every shipowner and shipmaster to enlist in a joint observational work which inures to his own safety and lends a helping hand to every meteorologist. If the solar light of day comes first from the East, we may nevertheless predict that the flood of scientific light necessary to elucidate the still obscure phenomena of American, and especially Western meteorology, will break upon us from the great Western Ocean. "The *improvement*" in the national tri-daily "Indications," etc., of the Signal Service, which General Myer hopes for, as his oceanic simultaneous work "progresses," cannot be doubted."

### ATLANTIC STORM TRACKS.

Similarly he shows how the international data, collected by the ships of every flag, are invaluable for discovering the normal or habitual tracks pursued by Atlantic storms, and thus how they affect European weather. The accompanying chart, which represents a section of the International chart of the ocean storm tracks for the Atlantic, in August last, will give the reader an idea of the work:

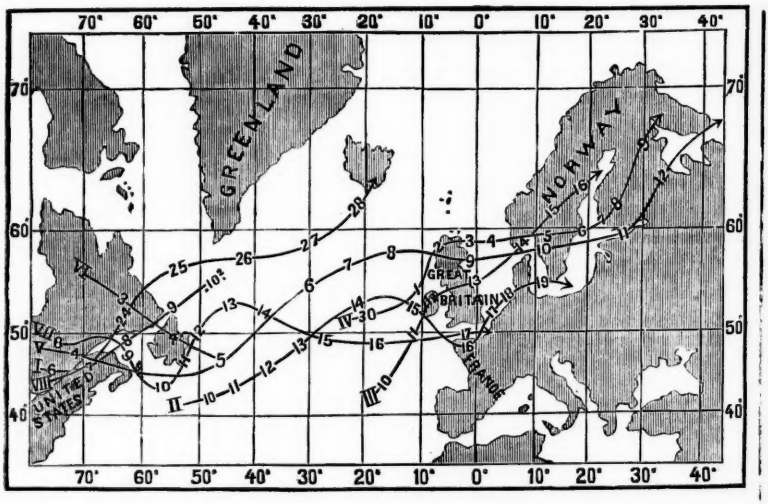
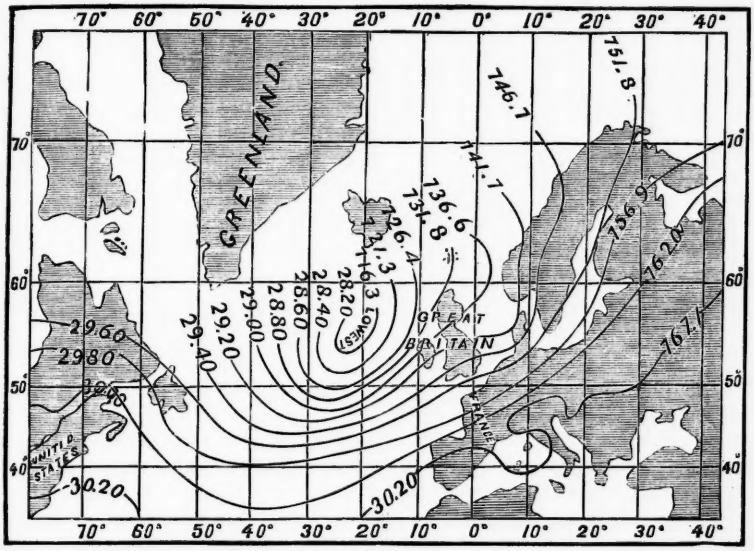



CHART OF OCEAN STORM-TRACKS BETWEEN AMERICA AND EUROPE.

[The dark lines show routes pursued by the August hurricanes; the numbers show the days of the month and locations of the storm center from day to day.]

The work of observing and charting the movements of ocean cyclones while crossing the Atlantic from the United States toward the British Isles, along the course of the Gulf Stream, is beautifully exhibited by the following chart, based on the international data:




AN ATLANTIC CYCLONE APPROACHING EUROPE, AS CHARTED FROM THE INTERNATIONAL WEATHER REPORTS.

[The circular area marked "LOWEST," shows the position of the storm vortex.]

The light afforded by such charts, on ocean meteorology, will gradually prepare meteorologists to anticipate the points on the British and French coasts, where American storms, in each season of the year, will strike. Thus, the data will prove of the highest utility to Europe as well as to America.

Again, the temperature and rainfall statistics gathered by the international corps of observers, have a most important bearing on all kinds of agriculture, and the writer shows how, had the international weather service been sufficiently extended last spring, the long wet season and cold summer of 1879, so disastrous to British crops, might have been predicted. "Ask," he says, "the British farmer what he would have freely paid in June to have gained some idea of the July weather. Or ask the English merchant what he would have given in June for a tolerably correct crop-forecast for the summer of 1879!"

## THE CLOUDS.

Equally valuable in the every day life of the merchant and the farmer will the study of the cloud-phenomena over large regions of the land and sea be found.

"Take a single illustration of the utility which such rules would have for the farmer, the sailor, or any close observer of the sky. Our storm-centers are generally preceded by a great bank of those clouds to which the name cirro-stratus is given. They are composed largely of freezing or frozen vapor, floating at great elevations, and often very far in front of the depression and over the belt of country which is to receive its rainfall. They move in parallel lines and are distinguished by their thread like and attenuated delicacy, as well as by their altitude—from 20,000 to 40,000 feet—from all local clouds. Outlying streaks of the cirro-stratus, frequently visible from twenty to one hundred miles in advance of the main pack, "like pioneers of the coming army," can easily be detected. But the main body, since it forms the familiar *halo*, can not be overlooked. It is the timely omen of the impending disturbance, delivering its faithful warning long before the barometer begins to fall and tell its confirmatory tale.

"Could the rural populations and those whose occupation calls them much out of doors be assisted in interpreting these and similar phenomena, however untutored they might be in meteorologic terms and theories, they would soon learn to forecast many of the great weather changes for themselves. But as the storm-signaling clouds, conspicuous to all, fly aloft in those mighty "upper currents" which observation shows, attain not uncommonly velocities of one hundred and twenty and sometimes even one hundred and fifty miles an hour, none but *strictly "simultaneous"* weather reports can adequately or truthfully reflect their actual, ever-flitting movements as related to storm vortices and other atmospheric phenomena, whose approach they foretoken."

Finally, the future applicability of this vast and exact observational system to the work of forecasting the character of coming seasons is presented. That its extension will make this in a large measure practicable, Prof. Maury elaborately shows, and illustrates by reference to the abnormally warm autumn and low pressure of 1879, which, with stations in the far northwest and British America, reporting the barometric and thermometric conditions, could have been predicted. He concludes—

"Could the international system of reports have been extended to the upper valley of the Saskatchewan before the enormous barometric anomaly of last fall developed, the prevailing weather of last September and October could have been then measurably foreshadowed, with almost as much certainty as, when a "cold wave" from the north is moving over the lakes any day in January, the Signal Office indicates 'cold weather' for the interior of the country."

# EVIDENCE FROM THE WEATHER MAP.

ISAAC P. NOYES, WASHINGTON, D. C.

Nothing could more conclusively prove a scientific statement than the weather for the past year has proved the correctness of the "New View of the Weather Question," published last year, in the July and August numbers of the KANSAS CITY REVIEW.

Here in the vicinity of Washnigton, we had a hot and dry summer. All through June and July and up to the middle of August we had very little rain—no regular storms—only a few showers of short duration. Vegetation was all drying up. The hay crop was only about one-half the average quantity. The grass all about, in the city and in the country, was brown and dead. There was no feed for the cattle excepting on the marshes near the river. The smaller springs and rivulets were so dry that it was with difficulty the farmers could get water for their stock; and as most of them could get no grass or feed for their cattle, they had begun to feed them on their winter's supply of hay and grain. The supply of vegetables was suffering severely for want of rain. The cry began to go round—"What shall we do for vegetables if it continues thus hot and dry? What shall we do with our stock?" Signs of rain appeared, but no rain came that amounted to anything against such protracted dryness.

All of a sudden, on the 15th of August, a change comes o'er the scene. On the morning of this day there is a marked change in the temperature, and it "feels" like rain, and all the "signs" seem as though they were genuine and would produce favorable results. Even the more inexperienced persons seemed to realize that "we are *now* going to have a storm"—and we had one. That afternoon it rained a little. The next day (the 16th), opened sultry and warm. The afternoon of this day we had more showers—it rained more and more. By early evening it was raining hard and rained all night. On the 17th we had heavy showers all day—raining most of the time. Large quantities of rain fell. It rained all night of the 17th and during the morning of the 18th. Toward noon of the 18th it held up and the heavy clouds began to pass over to the west, and by afternoon, about 4 p. m., the sun came out bright. We had had a fine storm and just what we needed—abundance of rain. The weather was much cooler and very pleasant. The next day we heard of severe storms at sea—all along the Atlantic coast to the north of Hatteras—with much destruction of property.

As there is a cause for everything, there is or was a cause for this sudden and agreeable change in the weather, and one that may easily be understood if we will only heed the knowledge that is so plainly spread out before us. But the world at large is loath or slow to look into things new, and they have little faith. They like to "wonder" what causes various effects in nature; and to many individuals there seems a greater charm in wondering and idealizing to no purpose on what causes these effects than in the practical investigation of them, whether it be

in regard to rain—too much or too little, or in regard to the wind—its direction, force and power to cause destruction, or some other subject quite foreign to this department.

As an illustration of this spirit, I quote from a popular writer—one who has superior advantages for acquiring knowledge, and who writes much on the various topics connected with natural phenomena, yet who refuses to make a proper study of the same in connection with the weather. "Whirlwind, tornado or cyclone, aerial or electrical, such visitations as that which has marked such destruction in Missouri, and was experienced in Connecticut last summer (1878), is equally inexplicable. It comes and goes "where it listeth," and man is powerless in its path. One feature of these exhibitions is the sharpness of the line between death and safety. Whether the width of the track be more or less, it is as sharply defined as the curbing of a city. An inch within the line and nothing can withstand the force of the elements. An inch without, and a baby's cradle will barely be rocked. Crude as have been the theories as to the cause or causes of these cyclones, they are not as much proved as they have been suggested; and if we knew all about them, there would be no possible mode of either preventing or escaping from them. Whither would we fly? Ordinarily the approach of a cyclone is indicated by a deadly stillness in and oppression of the air. There is no guide as to the direction it will take, and the first impulse to get out of doors may only expose one to death from unimpeded wind." * * * * * *

Now this, as a description, is very good, and there is much good comment; still, withal, there is throughout an ignorance of the weather system that is not justifiable in one who even in this short extract shows ability to grasp a subject so simple as the weather. But one great opposition that all things have to meet is that misapplied combative spirit that prompts many people to consider it an indication of greater wisdom to be sharp, to reject or oppose a newly revealed truth, than to accept it and combat earnestly for it.

These phenomena, such as the tornadoes that visited Kansas and Missouri and passed through Connecticut last year (1878), and the hot and dry spell this summer, up to the middle of August, and the sudden change that *reached Washington* on the 15th, and produced effects of storm, wind and destruction that were felt over at least one-half of the United States, *are not* "inexplicable." They are "unavoidable," and so are ten thousand other things in nature. But we have implanted within us a sense whereby we may explain many things that we cannot avoid. As every sensible person knows, there is a point beyond which we can not go; but because we cannot pass that unknown barrier in the weather question as well as in all others, it does not become sensible people to complain particularly of this branch of natural phenomena and to repeat their complaints and dolefully remark that "after all we don't know anything about this weather subject." To be consistent these people should show their want of faith in all branches of science; for certainly there is no subject that can be carried nearer to a first cause than this of the weather. There are certain facts in this department established

beyond doubt and controversy, facts that cannot be gainsayed by the most learned and combative opponent.

The great element that causes the change in the weather is the *area of low barometer*. This, like the sun and the planets, is all the while on the move, and like a great magnet causes the contraction of the air of the globe, as the magnet attracts the particles of iron; and essentially works on the same principle as a moving body of heat. Wherever it (*low*) is, the air is rarified and as naturally as water runs down hill the surrounding air rushes in and takes the place of the rarified air. The movement of the air brings along with it whatever is in its way, even as the Mississippi flood takes along with it whatever floatable gets into its mighty current.

Clouds are being formed everywhere and at all hours of the day. These, balloon-like, are likewise carried along with the majestic current of air toward the area of low barometer, and when these clouds become sufficiently concentrated in and about the area of low barometer, the same wind that has forced them on becomes the principal agent in causing them, by the process of squeezing, to precipitate the moisture again to the earth. The other and minor agent in causing this precipitation is the heat of the sun in its natural process of evaporation; and this will account for the higher strata of light clouds that move above the heavier strata below, and in quite a different direction from them.

Because we cannot avoid these things, or the reception of the *evil* effects from a storm as well as the good, it is no reason and does not become us to be satisfied with no knowledge of the storm, and to remain in ignorance of the beautiful laws that it obeys. Poor human nature is powerless to avoid many things detrimental to our interest and comfort (or what seems such), growing out of the workings of of nature. But this will never deter the wise from advancing as fast as it is possible for their faculties to lead them into the labyrinths of nature, whereby they may at least learn some points of the workings of Providence; and knowing these, have some little knowledge whereby they may understand how the effect is produced, if they have no power to control it or to trace it up to the full understanding of the Great First Cause in nature. The Great First Cause has been concealed from us for many ages, and this subject of the weather is not alone in not being advanced to a revelation of this great desire of the human mind. To trace it up to this point is all the human mind, in this sphere of existence at least, can expect or hope to attain unto.

To go back to the storm of the 15th of August, we seldom have a more marked exhibition of these meteorological changes. The changes which resulted in this storm were as marked as black against white; therefore making such a storm a fine instructive and positive illustration of the principles herein advocated. Prior to this day low barometer had been repeatedly traveling on a high line of latitude—about on a line between the United States and the Canadas, causing southerly winds which necessarily resulted in making it exceedingly hot all to the south of this line, and dry because the clouds that upheld the moisture were car-

ried beyond the lines that would affect all on the Washington line, or about 10° south of the center of this area of low barometer, or the storm center. For some reason, at present beyond the knowledge of man, the area of low barometer changed its course the next time, and instead of repeating itself in the Northwest, as it had done about all summer, started in the Southwest; so on the 15th of August, we in the Northern States had a sudden change of wind and consequently change in temperature, with good prospects of rain. In place of a south wind we had a north wind. Here in Washington it was almost cold enough for a fire. Later in the afternoon we had a little rain, which proved to be only the forerunner of a great storm. That night it was very cold for midsummer, the area of low barometer being to the south of us. The next day (16th,) here in Washington it was sultry and warm. Why this latter change? Simply because the very center of the area of low barometer was directly over and about us, and we again necessarily had the wind from the south. On the afternoon of this day (16th), it began to rain in heavy showers. These showers grew more and more frequent until toward evening it set in to one continuous and heavy rain, with a continuation of the warm temperature. Low barometer was passing over us still, to the Northeast. From the 17th to the 18th they got the storm up in New England. Some time during the morning of the 18th the area of low barometer passed off the coast, the *center* about on a line of 35 degrees, with lines reaching to the North, covering a good portion of New England. It continued to rain in Washington until about ten or eleven o'clock, but not very heavily. It was evident that the storm had spent its fury so far as this locality was concerned; but for localities further to the East and Northeast, they were just beginning to feel the results of the storm which were reported in the morning papers of the 19th of August as being very heavy, and the heaviest of the season.

We know the cause of low barometer on the land. By the aid of the telegraph it is easy to trace it; but its course on the ocean is yet unknown. Still, as remarked in the "New View of the Weather Question," it may be the reverse of what it is on land. I see no good reason why it should not travel after the same manner as on the land. Yet as illustrated not only in this storm but in many others, and in fact, almost always, the area of low barometer, when it passes off the coasts causes a northwest wind, proving either that the center of *low* must have passed to the southeast, else that another area of low barometer must almost always at the same time be in that locality (Devil's Corner), and of sufficient force to counteract the effect of the *low* that has immediately passed off the coast in our locality. We can not prove this, however, pro or con, until we can have some ocean stations, or till Congress will authorize a number of its idle naval vessels to be stationed along the coast, and to be in readiness and under the control of the Signal Office, to start at the proper time when a *low* is passing off the coast, and follow it up. Let not a hasty judgment be formed on one trial; but let it be repeated a number of times. For only by some such means can we hope at present to practically solve this question as to the direction of *low* along our coast.

This, as a scientific question, is well worth the trifling additional expense that it would cost the Naval Department to accomplish. Money expended in the interest of science is a gain and not a loss. It is a benefit to mankind, and one I think that the public would, on a full understanding, appreciate and endorse. It is well to move slowly in such matters; yet it is not well to retard the accumulation of wisdom, for thereby we only rob ourselves.

Phrenologically speaking "continuity" is large in the human race. We see evidence of this when any new idea is advanced, at least any idea that does not promise an immediate and profitable financial return. Yet many ideas, and perhaps most of the ideas that the world is slow to accept, are really of far more value even financially, than others that externally seem to be what are called good investments, and which the world are so eager to grasp. In many things the world is exceedingly short sighted. There is too little faith in the great moral principle embodied in that phrase "cast thy bread upon the waters for thou shalt find it after many days."

We want more "long headedness," more faith in what is right and true, and in those great principles that are of far more real value to the world than mines of gold and silver. In this subject of the weather there is much satisfaction and practical benefit. It should be more universally studied. Then it will be more easily understood. Every college in the land should take and peruse the weather-map as regularly as a well-to-do citizen takes the daily paper. This done, and in a short time the spirit of the weather question will reveal itself to the intelligence of the world, and through this grand power raise the weather question to an honored rank with the other noble arts and sciences of the earth.

The next area of low barometer that was developed in the West started on a higher latitude, the natural result of which was a return of hot weather, though not so hot as prior to the 15th of August, for three reasons: first, the area was not on so high a line of latitude; second, it having been cold, it necessarily took some time to heat up again; third, the sun was daily getting further and further to the south, therefore making it generally cooler at the north.

This fact of a return of LOW to a higher line of latitude, and the results therefrom, is simply noted here as a proof that LOW, as an agent or sub-power of the sun, was the controlling element in the case.

All science has its exceptions, or what appear to be such; so we have the saying that "exceptions prove the rule." What may be termed "exceptions" are simply the predominance of the stronger element. Nature is not so evenly balanced in any department as to have one train of results follow another like clockwork. There is always a struggle. That force which is strongest for the time being will prevail, whether it be heat or cold, or the advantageous position or relation of chemical attribute—a simple predominance of some element in the scale, so far as our faculties are concerned, making quite another whole out of the same parts. Why this is so, is a mystery to us—one of the mysteries to be solved in the ages to come—and only by analogy, it would seem, could we get a clue to the

unraveling of this mystery of nature. But for this element—*the predominance of the strongest force*—which may be termed a law in meteorology as well as in other things, we would not have the variety that is so often experienced. We would tire of a monotony, or be so affected by its results as ourselves to become monotonous beings and unable to cope with any of the untoward and trying circumstances that are so common in our every-day life. Nature, by her changes, her exceptions, drills us in a school that harmonizes with all her action,, and thereby prevents us from falling into any sluggish ways. She thereby sharpens our faculties and prepares us for higher and higher attainments. To ever be prepared for the "exceptions," should be one of our guiding rules through life.

About two months later (than the 15th of August), we had a change of quite a different character. Sunday, October 19, 1879, we had another remarkable change in the weather, which, it would seem from the map of the preceding day (18th), should not have been; for on the 18th of October it was, and had been, very warm for the season. At 7:35 a. m. the thermometer at Washington stood at 69°, and through the day the heat greatly increased, and it seemed like summer. The center of low barometer as to longitude was about on the line of 82° east from Greenwich—north of Ohio, in Canada—while its center as to latitude was about 47.30° north, making it generally warm over the greater portion of the United States east of the Mississippi River. This being the condition of things on the 18th of October, we in the vicinity of Washington expected that it would be hotter, if any change, on the 19th, and perhaps we might have some light rain. It was quite cloudy, it "felt like rain," and the weather map for this day if anything bid us expect a light rain. But on the 19th, instead of being warmer with a light rain, it became quite cold. A northwest wind carried all the clouds away and left the sky so clear that night that stars of the third and fourth magnitude were as plainly visible as on a clear, cold night in winter, and such small constellations as the "Dolphin" stood out in bold relief, it being a most beautiful night for "star gazing." Monday, the 20th, it was still cool and pleasant, though as the day advanced it began to get cloudy. The 21st it was much warmer, and we had a fine and gentle rain—the rain, it would seem, we should have had on the 18th.

All this time the LOW that was to the north of Ohio on the 18th had been traveling eastward, and the maps of the 19th and 20th showed LOW where it ought to have been, viz: in the northeast. On the 21st, in Washington and vicinity, we again felt the effects of a northern LOW, with mild weather and rain.

Why did we not have this rain before, and why have it now? Why a clear sky and cold, when it would have seemed that we should have had it warm with light rain? Why this double sudden change—first from rain to cold and moisture to dryness; then from cold to warm with rain?

There is one feature in this area of low barometer that is peculiar (yet it was referred to in the "New View of the Weather Question," published in the REVIEW, July and August, 1878); that is, a large area of low barometer will occa-

sionally divide up, and, in place of one large area of LOW, we have two or even more smaller and more concentrated ones. On the present occasion this was evidently the case, though it can only be proved under such circumstances as this happened to be, *a posteriori*, as the lower portion of the area of low barometer had passed off the coast. When this effect takes place on land, which it occasionally does, there is no trouble to prove it beyond all doubt. So there is no doubt but that it does take place, and when it takes place certain conditions of change are sure to follow. Now, when these changes are similar, even though this point has passed off on the ocean beyond our reach, we have conclusive evidence, particularly from the direction of the wind, as to where this area of low barometer must be, for, though the "wind bloweth were it listeth," it *always* "listeth" to blow toward LOW. From this fact we may, relatively to us, locate the direction in which lies the area of low barometer. On this occasion (October 19 and 20, 1879) it was as cold in Washington as in the northern part of New England, for the reason that we here had a northwest wind, while they had a southerly wind. Seven degrees of latitude would at this season of the year, under ordinary conditions, make a great difference in temperature; but on this occasion the wind that made it cold here came from further north than New England, while in the higher latitude of New England the cold was counterbalanced by winds from the south toward the northern area of low barometer on this occasion. This lower portion of the area of low barometer, which here caused a northwest wind, passed beyond our limits; so on the 21st we ceased to be affected by it, but were affected, or reaffected, by the area of low barometer that lay to the north of us, it being a continuous part of that which had passed off the coast on the 19th and 20th. Then followed a sudden change to warmer weather with rain, or taking up of the weather of the 18th—going back to it, as it were.

It is useless to refer to a multiplicity of these cases, unless their condition and change are uncommon. I will, however, mention one more case—one not so uncommon as these other two, but to show what effect the area of low barometer has upon the weather, making it relatively warm or cold without much regard to the season, be it winter or summer; that is, making it very warm for winter or very cold for summer.

December 3, 1879, an area of low barometer started in the West about on the latitude of Washington. On the 4th it was very well developed west of the Mississippi. The indications were that it would reach Washington about the 6th (Saturday), and, if it kept on a low line, make a cold north wind here that would result in a snow storm. But, as the area of low barometer almost invariably trends as it advances toward the east more or less to the north, the chances were more in favor of rain than snow. If LOW followed its usual course, it would rain, and be a warm rain at that. On the 4th it began to be cloudy here. On the 5th the cloudiness increased. On the afternoon of the 6th the advance of the storm proper, or rain area, reached Washington, and increased as it advanced. Toward evening the rain came in abundance, and the temperature continued very mild.

This mildness of the weather here proved that the center of the storm was to the north of this locality. From the effects of this LOW the weather was very mild for a number of days, proving that, though a winter month and the sun in the southern solstice, it will not be very cold so long as the area of low barometer is on a high latitude.

The area of low barometer immediately following this (of the 4th of December to the 8th), from the 8th to the 12th of December, went over almost the same ground and produced the same effect. It continued warm and commenced to rain, and cleared off in the same manner and in almost the same time to an hour. And thus it will do every time—like effects in this, as in other branches of science, will produce like effects.

In the storm of the 15th of August, as to temperature, we had an illustration of the effect of a low barometer in a low latitude in summer. On the 6th and 11th of December, in the same place, we had an illustration of a low barometer in a high line of latitude in winter. The effect of the former was to make it unseasonably cold in summer; the effect of the other was to make it unseasonably warm in winter. Whenever these conditions occur like effects will follow.

[Seeing that there was a little delay in the publicatlon of this article, the writer concluded to insert a few additional comments on the warm weather that we have had thus far this winter—January 10, 1880.]

Additional proof of the fact that Low, traveling on a high line of latitude causes it to be warm, is seen in the warm open winter which we have had thus far. Such weather—weather out of season—cannot be explained in any other manner; and this explanation is not only positive fact but as satisfactory as that heat will create warmth or that the magnet will attract iron. So long as Low continues to travel on this high line, so long will we have such results, and the higher the line on which it travels the warmer will it be. Not until Low travels on a lower line of latitude will we have cooler weather, and the lower the line on which it travels the colder will it be. On the latitude of Low depends the temperature of our planet—at least away from the immediate vicinity of the equator. Cold summers are caused by Low traveling on a low line—warm winters by it traveling on a high line. The fluctuation of Low is the great cause of the changeableness of our climate from season to season.

The location of the area of low barometer, as it were, defies the seasons. It is the great leveler and intensifier of heat and cold, dispensing its gifts without regard to seasons, bringing heat here and cold there at will, defying the apparent natural condition of summer and winter, tempering the heat of one and neutralizing the cold of the other. A sort of uncertain, capricious power that develops weather out of season, introducing sudden changes, transporting the sun's heat hither and thither quite in opposition to the location of the sun's position in the ecliptic, probably the most capricious, uncertain and mysterious power in all nature, the re-adjuster of temperatures—such is Low.

We know that Nature is abundant in her changes; yet the laws that gov-

ern the weather are not unlike any other laws of nature. The whole is after one grand general plan with infinite varieties in detail.

Perhaps some persons may think these comments and explanations ingenious rather than true. Let any one who may think so examine the weather maps for the days herein mentioned. These maps are not made to order to fit the storm, but are made prior to the storm—in advance of it. In other words, the conditions that will cause the effect are put into a stereotyped form and thus proclaimed and advertised to the world long before the storm reveals itself to the senses of man. A person who can doubt such evidence as this can have no faith in anything. Then, as a writer on this subject, I have no desire nor aim in making any other statement than the records of the daily weather maps will warrant. It would be foolishness in me to make any statements that are not positive facts for the mere purpose of sustaining any pet theory. Whether the facts will warrant the comments, that is another matter. They are here made with the utmost personal confidence in them, and they are intrusted to the future. Let the future disprove them if it can; so long as the interest of this department is advanced, it matters little. In this connection, let it be borne in mind that this science is yet in its infancy, and in this state it may not be unnatural to make some false steps, though the direction, as a whole, may be in the direct line of truth.

The more one studies this subject the more beautiful are its revelations and the more forcibly does it present itself that there should be more stations, especially in the Southwest—in Mexico—and that steps should be taken either to induce Mexico to establish a number of stations—say one on a square of every hundred miles—or else give the United States the privilege to do so, and in either case to have the daily reports transmitted to Washington, as are all the other reports. The Government should also exert itself to establish a station in the center of the Gulf of Mexico. This, with a few more stations in the extreme West, would give the United States a far more perfect and a most complete weather system.

Within ten years we have accomplished wonders in this line. The publication of the daily weather maps has proved to be one of the grandest inventions, acquisitions and incentives to science that the world ever had. Facts have been obtained and utilized that, but for this system, must have lain concealed with no hope of a resurrection or bringing to light.

It would seem to be wise in us not only to continue the present work, but to extend its borders, for thereby we extend its usefulness and add wonderfully to our storehouse of knowledge of the works of the Great Jehovah—the Great Architect of the Universe.

WASHINGTON, D. C. December, 1879.

# METEOROLOGY OF KANSAS CITY FOR 1879.

BY H. P. CHILD.

I have noticed in the REVIEW and our daily papers, Meteorological reports from St. Louls, Leavenworth and Lawrence, but none from Kansas City. Permit me to supply the omission with the following brief summary of the temperature and fall of rain and snow at this point during the year of 1879.

TEMPERATURE.

| MONTH. | 7 A. M. | 2 P. M. | 9 P. M. | MEAN. | Maximum Temperat're | Minimum Temperat're | Mean of Wrm'st Day | Mean of Coldest Day |
|---|---|---|---|---|---|---|---|---|
| January | 16.22° | 29.97° | 21.16° | 22.12° | 52° | —22° | 49.00° | —1.00° |
| February | 24.82 | 41.53 | 31.75 | 32.46 | 72 | 2 | 53.00 | 10.00 |
| March | 39.10 | 56.61 | 45.94 | 46.89 | 89 | 12 | 72.25 | 24.00 |
| April | 48.63 | 65.33 | 54.66 | 55.82 | 89 | 14 | 74.50 | 32.50 |
| May | 62.48 | 79.42 | 64.96 | 67.95 | 93 | 40 | 81.00 | 54.75 |
| June | 69.13 | 83.36 | 70.73 | 73.48 | 96 | 44 | 85.50 | 56.50 |
| July | 72.84 | 85.29 | 76.87 | 77.97 | 96 | 55 | 85.00 | 70.00 |
| August | 69.26 | 84.94 | 73.19 | 75.14 | 100 | 47 | 85.25 | 63.75 |
| September | 57.23 | 75.86 | 61.93 | 64.23 | 92 | 39 | 79.75 | 51.25 |
| October | 53.06 | 68.93 | 58.77 | 59.88 | 87 | 24 | 79.00 | 32.50 |
| November | 38.53 | 50.00 | 42.73 | 43.50 | 75 | 15 | 64.50 | 24.25 |
| December | 20.58 | 31.22 | 25.19 | 25.54 | 65 | —11 | 50.25 | —2.50 |
| Year | 47.65 | 62.70 | 52.33 | 53.75 | 100 | —22 | 85.50 | —2.50 |

PRECIPITATION.

| MONTH. | RAINFALL, in inches. | SNOW, in inches. |
|---|---|---|
| January | .84 | 1.70 |
| February | 0 | 4.85 |
| March | 1.05 | 0 |
| April | 3.56 | 0 |
| May | 1.99 | 0 |
| June | 9.02 | 0 |
| July | 6.35 | 0 |
| August | .65 | 0 |
| September | 3.55 | 0 |
| October | 4.74 | 0 |
| November | 5.57 | 1.50 |
| December | 3.05 | 2.00 |
| Total for the year | 40.37 | 10.05 |

Rain fell on 112 days.

Snow fell on 20 days.

Hail fell on 5 days.

First frost of the present winter, October 18th.

First ice of the present winter, October 23rd.

First snow of the present winter, November 28th.

# PHILOSOPHY.

## EVOLUTION AND CREATION.

BY GEORGE C. SWALLOW, M. D., LL. D., PROFESSOR OF AGRICULTURE AND OF NATURAL HISTORY, UNIVERSITY OF MISSOURI.

(*Concluded.*)

### II. BY NATURAL SELECTION.

But the most important modification of the theory of evolution, is that of Natural Selection, or the survival of the fittest.

By this theory Mr. Darwin and many others claim that the changes produced in animals and plants by food, climate and other causes, are preserved and transmitted when those changes improve the animal, and give him greater fitness for the conditions of life in which he has been placed; and that those not thus improved will be less able to sustain themselves and will perish in the struggle for life; and thus by the survival of the fittest, animals will be gradually improved until new species are formed.

It is claimed by this hypothesis that the progress of the species will be constantly upward, so that by this development, continued through the ages of the past, the low primeval species have been changed into the higher orders until the jelly speck has become the man.

It will be seen that the grandest results are claimed for this species of evolution. From it we have all the 500,000 varied forms, shapes and sizes which swim in the water, fly in the air and live upon the land.

Any system or theory which thus comes in to change the whole current of thought in our race, should come with good credentials and prove itself in perfect accord with the laws of nature, before it can be admitted as a principle of science.

True science is cautious and conservative; no defect can long escape its probe and scalpel. Very many important conditions must be fulfilled before this theory can be accepted as the origin of all the higher organic beings.

Among others it must be clearly shown that the first animals were of the lowest orders; that these were followed by those a little higher, and these again by others still higher—up and up by minute gradations, through all the thousands and thousands of stages to man, the highest in the scale.

But the facts show no such succession. There is, however, such an approximation to it, as could give the casual observer a plausible basis for the theory of Development. Some of the lowest animals did appear among the earliest forms of life; and there was a continual introduction of higher types until man comple-

ted the series. But when we examine this succession in its details as developed in the rock record of all the vast geological cycles, we find thousands of stubborn facts, which utterly preclude the idea of such a continuous and regular succession from the lower to the higher as the theory demands. A few only of these facts can be examined at this time.

1. In this rising development of the animal kingdom, we have five very marked stages of progress, each represented by a sub-kingdom in the classification. In the Primordial strata, the very oldest rocks known to contain animal remains, we find *Protozoans*, *Radiates*, *Mollusks* and *Articulates*, representing four of the five sub-kingdoms; and these four contain more than nine-tenths of all the animals that have ever lived. If, therefore, development be true, it made a thousand fold more progress at the very outset, when it was working upon microscopic mites, than it has since through all the vast cycles of the Silurian, Devonian, Carboniferous, Reptilian, Mammalian and Human ages. This is scarcely credible.

2. The theory demands a regular succession from the lower to the higher in a continuous series both in time and grade. But the facts show this is not so in a vast number of cases scattered through the whole series from the lowest to the highest. As an illustration, Cephalopods, the very highest order of *Mollusks*, and *Trilobites* high among the *Articulates*, appeared among the first animals, and the first fishes were much more perfect than their immediate successors, and even than many now living.

If the Armor-bearing fishes were developed into the Salachians which succeeded them, the progress must have been like Virgil's *descensus in averno*, easy and downward.

3. Since this theory depends upon the survival of the fittest in the struggle for life, it made a grand mistake when it filled the early seas with a huge race of mailed sharks and ganoids, to be the progenitors of the more perfect and wholly defenseless *Teliosts*.

Science has failed to show how the Cod and Turbot could be the fittest to survive in the struggle for life with their progenitors, the Sharks. There are hundreds of similar impossible successors.

4. Many animals and plants have had no ancestors and no progeny. Trilobites had neither ancestors nor posterity. There was no animal for them to be developed from, and they left none to be developed into. It would take a strong power to develop the Elephant out of any animal that lived before him. The same is true of whole races of plants; as our deciduous trees.

5. The theory demands not only that the lowest of any given order should appear first, but that the highest of the lower order should be followed by the lowest of the succeeding higher order, family or genus. Thus: if A, B, C and D represent successive classes, and the numbers 1 and 5 represent the different orders in these classes, the theory would demand a regular succession from 1A to 5D. Thus—1A, 2A, 3A, 4A, 5A, 1B, 2B, and so on to 5D. But in fac

we usually find the lowest order of any class preceding the highest order of the lower class, thus:

1A, 2A, 3A, 4A, 5A,
1B, 2B, 3B, 4B, 5B,
1C, 2C, 3C, 4C, 5C,
1D, 2D, 3D, 4D, 5D.

The last arrangement represents the actual order of progression from class to class in a vast number of cases; as the transition from the Mollusks to the Articulates.

The Devil fish is the highest of the Mollusks, and the Worms the lowest of the Articulates. But according to the Theory, the Devil fish should be both lower than the Worm in the scale of being, and prior to it in point of time; whereas he is just the contrary in both respects. The Worms were among the earliest animals, and the Devil fish, among the latest. And yet the Devil fish must violate all sense of propriety and all order of time to make the theory good. He must perform the double miracle of transforming his magnificent proportions —a body as large as a steamer's boiler, and arms as long as the jack-staff, into a puny mud-worm, which lived millions of years before his ancestors, the Devil-fishes, were born.

So often is this arrangement true, that it becomes the rule rather than the exception, and appears to be an insuperable objection to the theory.

Many of the changes demanded by Evolution are so supremely preposterous as to provoke a smile and leave the conviction of utter impossibility. The highest Articulate is a tiny insect, and the first Vertebrate, the next in order of the grade, was a huge fish covered with a thick coat of mail. Could you see the earliest fish ever found on this continent as nature embalmed him in the rocks of Indiana, side by side with his insect ancestor, you would think it would require about as much of a miracle to develop the fish from such an ancestor as it would to make him from the dust.

6. If all plants and animals have been born of development, there ought to be some proof of such changes within the 5,000 or 6,000 years of the Historical Period. But there is no record, no proof, no claim that a single species has been produced in these long ages. Some have become extinct; but none have been added even by man's aid. We are reminded of many changes producing varieties; but of none that claim the distinction and permanence of species. And besides, nearly all the important variations have been produced by man in the domestic state.

The variations of the domestic pigeons are perhaps the most marked, and Mr. Darwin has made them most prominent. Still the extreme varieties are fertile among themselves, and their progeny show marks of the original stock and a disposition to return to the Rock-Dove.

We are also referred to the Berkshire as a great improvement on the wild boar, and the Spanish Merino on the wild sheep. But there is about as much

proof that the Hydraulic Ram is the result of development as there is that the Spanish Merino comes from a survival of the fittest in a region populated with bears and wolves and hyenas and lions.

But what claim has the Berkshire to superiority as the fittest to survive? Fat? Yes, fat brings more dollars and cents! but dollars and cents do not mark the scale of superiority among animals. If fat makes perfect, then the opossum is superior to the squirrel, the hog to the horse, and the African to the Caucasian.

If, however, the Berkshire is a fair sample of development, he should be able to survive in an open struggle for life with his undeveloped ancestor. The test is easily made. Turn your Berkshires into the forest with the wild hogs; place them together for the struggle in the same arena where the survival of the fittest, according to the Theory, has won so many victories in producing so many thousand new animals. No one can doubt the result. If the Berkshire survives at all, it is because he will lose what makes him a Berkshire, because he becomes a wild hog, as many a fat pig has done before.

This trial was made under the most favorable circumstances during the late war. By Order Number 11, Berkshires, Chester Whites, Poland Chinas, and Racers were turned out to struggle for life in our western counties. A few years after I was surveying that country and saw many of these hogs and their descendants. But few indications of the improved breeds remained, and the younger specimens bore decided marks of lapsing to the original type. And this is what we should expect from the very laws of life.

There are volumes of facts to show that horses, oxen, dogs and hogs, running wild, gradually lose all domestic variation and assume a uniformity of color, size, and structure supposed to be, and in some cases known to be, like the primitive wild stocks.

This is clearly shown by the wild horses of Tartary, and in a less degree by the wild horses of the Falkland Islands and South America, and the semi-wild herds of the North American Indians. The wild horses of America have changed less as they have been in a wild state a much shorter time.

But the variations in domestic animals are much less than would be, at first thought, supposed. Those which are at all marked, are confined to a few species; while the others have scarcely changed at all for many thousand years. Many figures and embalmed specimens of our domestic animals and plants, have come down to us from the ancient nations of Mesopotamia and Egypt, which shows that their living descendants have made no material progress for the last forty or fifty centuries. We also have still more ancient proofs of this permanence of type in the domestic animals and plants from the ruins of the Swiss Lake dwellings, and the Danish Shell-heaps, and the Cave-dwellers of Central Europe.

Should it be even admitted that domestication has produced new species, the fact would scarcely make the evolution by natural selection possible; since there is so little analogy between the possibilities of the domestic and wild states.

You might as well attempt to prove that our native Crab-apple was developed from the Haw, because man can grow Bellflowers on the domesticated Siberian Crab, as to prove the horse was developed from the ass, because the carrier pigeon is the progeny of the wild Rock-dove.

This difference of possibilities between the wild and domestic state, is well shown in the hog and pigeon. Great as are the changes produced in the domestic hog and pigeon, it is known that their wild representatives have made no perceptible changes since the flood, either by natural selection or by the survival of the fittest.

If then we would measure the probabilities of forming new species by natural selection, our illustrations must come from the natural or wild state ; since that is the only state where natural selection can act, and the only place where species have been formed, if formed at all, by natural powers.

We must, therefore, hold the changes produced by man in domestication, of little value in this discussion.

7. But every one of the numerous breaks in the series of animals, has a significance of the highest value in this relation, since each and every one of them must prove fatal to evolution. For Pope's couplet is emphatically and literally true here :

> "From nature's chain whatever link you strike,
> Tenth or ten thousandth, breaks the chain alike."

And yet there are hundreds of thousands of these breaks, missing links, impassable gulfs, over which science has found no bridge.

But it is said the missing links are buried in the Geological Records. This is a delusion ; for Geology is the most unhealthy place for Darwinism imaginable.

To illustrate : let us examine one only of these many thousand breaks in the succession ; and let us take one with which all are familiar, and one that presents the fewest difficulties to the progress of evolution—the link between the monkey and man in its physical aspects.

All admit there is a break between the man and the monkey, as they now exist, which must be filled by a series of beings gradient by small steps of progress from the monkey to the man. These gradient beings must have been very numerous and of too remarkable a character to be overlooked if now living, or for their remains to be lost, if they ever did live.

(a.) It is very remarkable that all these gradient animals, which connected these two living races, and by which the monkey was developed into man, should have utterly perished. All the gradients, all the links between the Carrier Pigeon and the Tumbler, and those between the Bull-dog and the Grey-hound, are still living and more numerous than ever before. Will some Darwinian tell us why all of man's nearest and best ancestors have become extinct, while the hundreds of thousands more remote and less desirable, still live like poor relations to remind us that we are something worse than mortal ?

If these gradient animals between the man and the monkey were fitter to

live than the monkey, as the theory of Evolution implies, why have they all perished while so many monkeys live?

(b.) Men and monkeys have lived together upon the earth ever since the origin of man, some time in the Drift Period, which evolutionists say was 300,000 years ago; and the monkey came into being in the Eocene, the dawn of the vast cycles of the Tertiary. This surely gives us time enough to test the theory.

The monkeys have left their remains, recording their history in all the rocks of these vast cycles and in all the continents, in Asia, Africa, North and South America and in Europe. Their history has been tolerably well written up.

Man has lived in Europe since the Drift Period, in Asia and Africa probably as long, and in America nearly as long. He has buried his bones and scattered with free hand his implements, his carvings, his monuments, his temples, his dwellings, his traditions, and his books all along the ages and all over the world. From these abundant materials, man's history, too, is pretty well made up.

Man has searched with untiring zeal for all that is new and old; he has desecrated tombs and temples to lay open their mysteries; he has exhumed ancient cities—Herculaneum, Troy and Nineveh give up their hoary records—he has, also, fished up from the depths of Swiss lakes the remains of their ancient Lake Dwellers; unearthed the Mound-builders and Aztecs of America; dug up the Cave-dwellers of Europe; and searched all the rocks these hundred years; and yet he has not found a mark nor a fragment to show there ever were any beings between the man and the monkey, that man was ever any more like a monkey than he now is, or that the monkey was ever more of a man than now.

The embalmed men and monkeys of the Egyptian tombs, are the same as the living men and monkeys; no nearer together, no farther apart.

The still more ancient traditions and mythologies make the most ancient men heroes and demi-gods, quite as perfect as we are.

Of the pre-historic man, the most ancient relic found in Europe about which there can be no doubt or dispute, is the Engis skull. Of this skull, Prof. Huxley says: "It is a fair human skull."

The oldest skull found in America about which there can be no question of origin, is the New Madrid skull, which is a fair Caucasian skull, It might have been that of a Hebe or of an Eve.

We also have ancient skulls of a lower type; but none lower than the skulls of some living men.

The history of the monkey shows that he is no nearer a man now than he was at the beginning. The rocks show no intervening varieties.

We must conclude, therefore, that the wide chasm between the physical structure of the man and the monkey is not and never has been filled; and that there is no evidence whatever making it physically possible to derive man from the monkey.

III. EMBRYOLOGY

But one of the most plausible arguments of the Evolutionists is drawn from Embryology. The embryos of the higher animals resemble the embryos of the lower ones in the early stages of development; therefore, the higher animals are developed from the lower. As the embryo of a man is like a fish at one stage of its development, so man was developed from a fish.

But Agassiz, who had studied Embryology more thoroughly than any other man living or dead, said this argument had no valid foundation. No embryo has produced a being either above or below the parental species. Prof. Virchow, the best living authority, bears the same testimony as Agassiz.

IV. THE ORIGIN OF THINGS.

But if all other difficulties were removed, if there were a complete series of animals from the lowest to the highest—all having such close affinities that each could be traced to its ancestral species, there would still remain three insuperable objections to Evolution as a system of nature.

1. It does not account for the Star-dust, the original matter from which the worlds were evolved.

Development is the evolving of something out of something else, or some other thing. Hence Development cannot evolve something out of nothing, or the original matter of the worlds out of nothing.

And, besides, Development acts by the laws of nature and by these laws only. But these laws are mere properties of matter, inherent in and dependent upon matter for their powers of action and for their very existence. These laws, therefore, or Development acting by them, cannot originate the matter of which they are the mere properties.

Science clearly indicates a first cause, which must be without and superior to nature. Science too, as such, must accept whatever first cause best meets and explains all facts and conditions of the natural world, whatever first cause is in best accord with science itself, or the laws of nature.

Several theories of the origin of the material world have been proposed. But that promulgated more than 3,500 years ago by one Moses, a learned Egyptian, declares the first cause to be a supreme being, immortal, invisible, all-wise, benevolent, and the Creator of all things.

Scientists have generally accepted the *Mosaic Theory*, as in best accord with the teachings of science itself. It is true that men love to hear and believe something new and strange; but neither common sense nor science will give up this theory of a Creator until something better is proposed. You might as well expect the passengers of an ocean steamer to give up their good ship in mid ocean and take passage in a leaky skiff, as to give up the Mosaic Creator for Evolution

2. Evolution gives no solution of the origin of life and the peculiar structure of Organic Beings.

Science has clearly shown there was a time when neither plant nor animal

existed on the earth; when there was nothing but inorganic matter, dust and rocks.

There were no laws governing life and living beings; for there were no life and living beings to be governed.

But in the progess of events, plants and animals appeared upon the earth, and with them the laws, such as digestion and assimilation, which control organic beings.

Several theories have been proposed to account for the origin of living things. Among others we have had Spontaneous Generation, the Fortuitous Concourse of Atoms, and Evolution. Which of these is most plausible, I am unable to tell. And it would be difficult to say in what they differ.

But none of them are known in nature; science has as clearly proved them impossible as it is possible to prove a negative, by showing that all living things come from eggs and that all eggs are produced by living beings. So certain are we of this that our laws and jurisprudence are based upon it. Upon its certainty we imprison and hang men and women. In short we hold this scientific principle more sacred than we do property, character and life itself.

How then can we believe in spontaneous generation? in the evolution of animals?

It is quite certain that Evolution cannot produce living things; for in them we find life, and new laws so strong as to overcome the pre-existing laws. The laws which raise up the oak and the elephant, overcome gravity and inertia; and those which form sugar, starch, blood and muscle, overcome the pre-existing affinities.

Evolution can only transform, and there was nothing in nature to be transformed into life.

But it is said that Evolution works through the laws of nature. But no facts, no science, has shown that one law can produce another law superior to itself.

It is therefore utterly impossible for the Evolution Theory to account for the origin of organic beings, and the laws of life.

Here again, the Mosaic Theory is the only one, yet proposed, able to solve this problem of the origin of living beings. The Supreme Being of this theory, has the power, the wisdom and benevolence to give the life and the superior laws of organic beings. And there are no facts, no science, which militate against this Theory of Creation, though promulgated 3000 years before the rise of modern science.

If on the morrow, we should find new houses and cities springing up all over our prairies, houses not made with hands or any other known power; if we should see the soil rise up into the houses and form itself into foundation ashlars harder than adamant and more beautiful than rubies; the clay rise and form itself into bricks in the wall, more delicate than opal, and the sand into windows as clear and sparkling as diamonds—all forming houses more gorgeous and brilliant than the palaces of the Arabian Nights; if we could see cars rolling through

the mid heavens without track or engine, but self-poised and self-impelled, and leaving trails as bright as rainbows; if on the morrow we should see for the first time such wonderful beings with power to multiply themselves indefinitely, would we say they had sprung spontaneously from the earth? that they had been produced by development? or rather, would we not say they are the work of some supernatural power? that they are the creatures of the Supreme Being of the Mosaic Theory.

Should such new and wonderful beings appear, it would not be so strange as the first animals and plants were. Man might think he could build a house; but none save Drs. Crosse and Bastian, would undertake to make the oak or the elephant.

3. We find in man, in all men everywhere, a strong innate apprehension of some external invisible power, which, in greater or less degree, molds our destinies and metes out to us the good and evil of life; whose anger, therefore, all deprecate with sacrifices, and whose favor all propitiate with prayers and vows. Some call this universal element of man's nature by one name, some by another. Comte calls it superstition, Virgil, piety, Sir Humphrey Davy and Dr. Carpenter call it religion.

Call it what you will, no animal but man has it. No animal but man has a moral nature, knows right from wrong, repents, prays, sacrifices. No monkey has superstition or religion; no brute fears or loves the unknown powers, whether they be gods or demons.

Hence there is nothing in the brute that can be developed into man's religious nature. You might perhaps develop a monkey out of his tail, and make him stand erect; his posterior hands may be transformed into those beautiful things concealed in No. 2 gaiters; the teeth and facial angle changed; the diabolical grin transformed into the ineffable smile of a mother's love; yea, and that tongue taught to utter the words of affection, fidelity and truth. While we admit the possibility, but not the probability of these wonderful changes, we most positively declare that science has shown no fact, developed no principles, indicating the possibility of deriving man's moral and religious natures from any intellectual power of any brute.

But the Theory of Moses recognizes and provides for this higher nature of man. "God breathed into his nostrils the breath of life, and man became a living soul," an "Image of God."

Thus Moses places man infinitely above all other animals, gives him a brotherhood with angels, and a sonship in Deity.

Shall we then give up this Creation of Moses, which thus elevates us and unites our destinies with the infinite, for this Evolution of Darwin, that links us to the worm, gives us a sonship in the monkey and binds us to the beasts that perish?

As a Christian student of science, I protest. In the name of all the splendid achievements and utilities of science, in the name of all the grandeur of moral truth, and all the sublime hopes of immortality, I am compelled to protest against such a sale of man's birth-right.

# BOTANY.

## GEOGRAPHICAL DISTRIBUTION OF CERTAIN TREES AND PLANTS IN MISSOURI AND KANSAS.

BY PROF. G. C. BROADHEAD, PLEASANT HILL, MISSOURI.

A thorough study of the passage of the flora of the woodland regions of the Mississippi valley to that of the prairie regions lying west, involves much labor, with instructive results.

Starting from the warmer temperate zone near the mouth of the Ohio river, passing a little north and then westwardly as far as central Kansas, we cross about five irregular and obscurely defined timber lines.

I. The first may include the swamp region of southeastern Missouri, extending into Arkansas on the south and into Kentucky and Tennessee on the southeast. Trees peculiar to this district and not found northwardly, except where transplanted, are: *Taxodium distichum*, or bald cypress, *Catalpa bignonioides*, *Nyssa aquatica* and *N. uniflora* (tupelo), and *Gleditschia monosperma*, or water locust. Occasionally, growing upon these trees, may also be found the *Phoradendron flavescens*, or mistletoe. The elevation of this, generally swampy, region is not much over 300 feet above the sea, and is very heavily timbered.

II. The second zone may be called the pine belt. Its northern line passes westwardly through St. Francois, Washington and Pulaski counties, and southwestwardly through McDonald county, Missouri. Its elevation reaches from 400 to 1,400 feet above the sea, and it is generally heavily timbered. The underlying geological formations are chiefly of the older Palæozoic—lower magnesian limestone and sandstone of the Calciferous and Potsdam, resting in the Iron Mountain region on Huronian porphyries. On the higher flinty and sandstone ridges the yellow pine (*Pinus mitis*) is often found, forming extensive forests of excellent timber. The black gum (*Nyssa multiflora*) grows throughout, but is found no farther north. The yellow poplar (*Liriodendron tulipifera*) is found only in southeastern Missouri, extending from Madison county southwardly and eastwardly. The sweet gum (*Liquidamber styraciflua*) and witch hazel (*Hammelis Virginiana*) are also only found in southeastern Missouri and southwardly. The Wahoo elm (*Ulmus alata*) is quite abundant near the Iron Mountain, where it attains a diameter of one foot and a height of forty feet. It disappears at the Missouri bluffs, where it is found only as a small bush a few feet high. The *Bumelia lanuginosa* is also found as far north as the Missouri river and as far west as Jefferson City. Thence its northern limit passes southwestwardly through Cedar and Jasper counties. It very much resembles the Osage orange bush.

In northern Arkansas the chincapin (*Castanea pumila*) is often found,

and attains the size of a small tree. It may rarely be found on the south line of Missouri. In southeastern Missouri, southern Illinois, and eastwardly, the beech (*Fagus ferruginea*) is found.

Nearly the whole of this district is well timbered, for, besides its extensive pine forests, the white oak, burr oak and post oak are common everywhere, and we occasionally find dense cedar groves.

III. This zone lies north of the last, its northern boundary extending from northeastern Missouri southwestwardly via Boonville, through Henry, Cedar and Jasper counties, Missouri, and Cherokee county, Kansas. It lies from 500 to 1,500 feet above the sea. It includes the oaks above named, and is the extreme western limit of the blue ash (*Fraxinus quadrangulata*), the hornbeam (*Carpinus Americana*), the alder (*Alnus serrulata*), the flowering dogwood (*Cornus florida*), and the huckleberry. Valuable timber is abundant, consisting of oak, walnut, hickory, ash, sycamore, cottonwood and maple. This portion of country is chiefly underlaid by Silurian, Devonian and Carboniferous rocks, mostly limestones.

Passing from the woodlands of Missouri, we notice a gradual disappearance of large bodies of timber, with the loss of some well known trees and much of the characteristic undergrowth. The prairies are large, and a western flora appears. The sassafras and white walnut (*Juglans cinerea*) we find in Saline, Lafayette and Carroll counties, Missouri, but no where else beyond the bounds of our third zone. The red birch (*Betula nigra*) and the trumpet creeper (*Tecoma radicans*) extend as far west as Pettis, Johnson and Bates counties, but no farther west.

IV. Another partially defined boundary may extend southwestwardly from the Nodaway river via Kansas City and along the western boundary of Missouri southwestwardly. West of this we do not find white oak (*Q. alba*) and swamp white oak (*Q. bicolor*), and the laurel oak (*Q. imbricaria*), in a few instances, is found west. Certain smaller plants extend westwardly and southwardly, but are not found east, viz: *Oenothera speciosa* and *Salvia azurea*.

V. This extends from the last to what is known in Kansas as the "Flint Ridges." This ridge enters Kansas on the line of Chautauqua and Cowley counties, and trends northwardly. Its elevation here is from 1,600 to 1,700 feet above the sea, and is a good natural division. The black walnut, red elm, American elm, box elder, sycamore, cottonwood, white maple, hackberry, redbud, red oak, pin oak and burr oak are the principal trees and are also found East. In the eastern part of Kansas, and especially near the larger streams, the Maries des Cygnes, Kansas and Missouri rivers, are some good bodies of timber; but going westward we find the timber restricted to the valleys—the belts becoming narrower as we go west. The hazel is found in Anderson county, but not much farther west. The shellbark hickory stops at Walnut creek in Greenwood county. On some of the larger streams the trees are tall, but westwardly we find them depressed and rough looking. In the western portion only three oaks remain—the burr oak, red oak and pin oak. All the trees have become dwarfish, and the burr oak, black walnut

and elm are short and stout. We find also that the bark of most trees appears more gray in color. The strawberry, *Fragaria Virginiana*, is not found west of the "flint hills."

VI. This zone may almost be called treeless, for only stunted trees are found along the larger streams, and fuel is scarce. Near the Arkansas the "sand plum," a dwarf plum (*Prunus texana*), is abundant. We also find the *Ribes aureum*, or yellow flowering currant, on limestone glades bearing fruit, whereas eastwardly, when put out for ornament, it is said not to fruit.

## GENERAL REMARKS.

The American plum, blackberry, raspberry, pawpaw and gooseberry grow throughout the various districts just named. Probably also the *Vitis riparia*, *V. cordifolia*, and *V. aestivalis*, var? *cinerea?* Eng. The *Prunus chicasa* grows in I, II, III and part of IV. The *Ptelia trifoliata* occasionally is quite abundant in II and III, but rarely in IV, while I have found quite a number of bushes of it at Avondale, Franklin county, Kansas. The *Acer saccharinum* or sugar maple is occasionally quite abundant in Eastern Missouri, also on the Missouri river bluffs as far as Platte county and is reported to be found near Fort Scott, but no farther west. The *acer rubrum* or red maple is only found in Southeast and central Missouri. The *Ostrya Virginica*, or iron wood, is found on rocky hillsides as far west as the Verdigris river. The black jack (*Q. nigra*), is generally common wherever sandy soil exists, and is found as far west as Greenwood county, Kansas On limestone bluffs in Western Missouri and Eastern Kansas the *Quercus Muhlenbergii* is generally common, growing to a diameter of two to three feet. Post oak is generally associated with black jack, although it selects a little better soil. The black jack prefers sandy soil, the post oak requires some clay with it The pecan (*Carya Oliviæformis*), is found on the Mississippi bottoms above its junction with the Missouri, and along the Missouri as far as the vicinity of Kansas City, on North Grand River to Utica, is abundant on the Maries des Cygnes, in Bates county, Missouri, and is also found near Ottawa, Kansas. It abounds also on the Little Osage, Marmaton and Neosho rivers. Near the Flint Hills, the only hickory observed was the common pignut. The persimmon (*Diospyros Virginiana*) is not found in Northwest Missouri, but is found in Linn and Clay, and thence southwestwardly in Kansas. The cedar (*Juniperus Virginiana*), although common in Central and Southeast Missouri, is elsewhere rare, but may be expected on rocky bluffs. I found it in Cowley county, Kansas. The leatherwood (*Dirca palustris*), is abundant on some bottom lands in Madison county, Missouri, and is also found in Warren and Calloway counties, but no farther north or west. On the prairies in Western Missouri and Kansas wherever limestone approaches the slightly moist surface we are generally sure to find the *Desmanhuts brachylobus*, and where the same soil, overlying limestone, is dry we may find the *Helianthus orgyalis*. The latter plant is generally called "rockweed" near Fort Scott. The large plant *Helianthus lenticularis*, in some parts of Western Missouri and Kansas

abounds on rich black soil. A few years ago the *Solanum rostratum* was restricted farther west. It is now found in Saline county, Missouri. The beautiful *anemone Carolinianum* is found in Western Missouri and westwardly. The handsome *Callirrhoe digitata* I have only seen on limestone and flinty soil in Southwest Missouri. The *Clitoria Mariana* is only found on dry pine ridges of Southeast Missouri. The *Oxytropus Lamberti* I have only seen in extreme Northwest Missouri. The *Œnothera speciosa* abounds in Western Missouri, southwardly and westwardly. The *O. missouriensis* is rare in Southwest Missouri, more common westwardly. The *O. serrulata* abounds in Butler county, Kansas. *Silphium terebinthinaceum* abounds in Southern Illinois, Southeast and Central Missouri. *Conoclinium cœlestinum* is abundant in Southeast Missouri, and is also found in Cole, Bates and southwardly. The *Amphyachyris dracunculoides* is common in Western Missouri, Kansas and southwardly. *Pentstemon grandiflora* is found in Atchison county, Missouri and in Kansas, becoming quite common in Butler county. It is quite handsome. *Salvia azurea* is abundant in Western Missouri and Kansas. *Phlox acuminata*, common in Southeast Missouri, also found in Cole and Vernon counties, but not northwardly or west. *Sabbatia angularis*, found on dry ridges in same districts as the last. *Gentiana quinqueflora* has only been found in cool, shaded places in Adair county, Missouri. *Euphorbia marginata* abounds in Kansas. *Yucca angustifolia* I have found in Atchison county, Missouri and Elk county, Kansas. That handsome cactus the *Mammilaria Missouriensis* is occasionally found where there is but little soil upon the limestones of the Flint Hills in Butler county, Kansas. In Kansas, as far as Butler county and probably farther, the *Psoralea floribunda* is very abundant upon the prairies. In Greenwood and Butler counties the *P. argophyllta* is occasionally found and the *P. esculenta* is found from the western line of Missouri westwardly. In Anderson county, Kansas, the *Callirrhoe involucrata*, *Eryngium Leavenworthii*, *Jussiæa Grandiflora*, *Stenosyphon*, *Virgatus* and *Baptisia Cœmlia* were observed; but we have no information of these plants occurring any farther east. Here was also found the *Nymphæa adorata*, *Brasenia peltata*, which have also been found in Barton county, Missouri. In Woodson and Greenwood counties, Kansas, the *Nemastylis acuta* and a pale blossomed *Callirrhoe* were observed. Four or five ferns have been observed in Kansas growing upon rocks, viz: *Notholena dealbata*, *Woodsia obtusa*, *Pellica atropurpurea Asplenium ebeneum* and an *Adiantum*.

ADDITIONAL NOTE.—The black oak may be found as far west as the post oak. The service berry being (*Amelanchier Canadensis*) I have found on Marais des Cygnes bluffs, Franklin county, Kansas, also at Kansas City. It is common eastwardly.

## DISTRIBUTION OF PLANTS.

BY REV. L. J. TEMPLIN, HUTCHINSON, KANSAS.

The world is full of wonders to every one who has not made up his mind to be astonished at nothing he may see. To the thoughtful mind there is much in nature to inspire wonder and admiration. The wise adaptation of means to ends, and the beautiful harmony that exists throughout all the realm of organic nature lead the mind, free from bias, to the inference that some wise, intelligent power orders and governs all these relations and harmonies. Perhaps nowhere in nature is there a more manifest exhibition of wisdom in the adaptation of means to the accomplishment of a worthy purpose, than is seen in the various methods employed in nature for the dissemination of plants by the distribution of seeds.

In looking at this subject with an intelligent eye, the mind cannot shut out the conviction that some intelligent designer must have been employed in planning this scheme that has so much of both excellence and variety to recommend it to the judgment To say that all this is to be attributed to chance, is to endow chance with all the attributes of a Deity, which is the very reverse of the idea intended to be conveyed by the term. In the sense intended it is perfectly absurd to attribute this or any other work to chance, for in that sense chance is nothing, and consequently can do nothing. So we regard it as the result of evolution; but I cannot see that this relieves the difficulty, even if the truth of the theory of evolution be admitted. Evolution is simply the working out of certain results under the operation of law. But what is this law? It is not correct to say that it is force, though I think many make this mistake. Law is only the established order or manner in which force operates; so that if we admit the intervention of law and a thousand or ten thousand secondary causes, still this law must have originated with a Law-giver, and behind all these secondary causes the mind must rest at last on the First Cause, the Author of all other causes. But I did not start out to write a moral or philosophical essay, but to call attention to some of nature's methods of distributing the vegetable kingdom over the world. In producing these results we find three classes of agents at work: the waters, the winds, and animals, besides certain arrangements within the plants themselves for the accomplishment of this purpose. And we find the seeds themselves adapted to these different means of transportation. The light character of many seeds well adapts them to floating from place to place, while their impervious coverings protect them while being carried long distances by the currents of the ocean or of rivers, and then when they lodge on some island or other shore they readily spring up and grow. What, for instance, can be better adapted to floating from island to island than the tough, corky covering of the cocoanut? The seeds of grasses and other plants are washed down from the higher grounds by streams, and they are thus widely distributed.

The seeds of many plants, as of the dandelion, thistle, and a long list of similar plants, are furnished with a tuft of downy or silky pappus, that will enable

them, when ripe, to float away on the breeze and thus be scattered far and wide. The seeds of some species of poplar, as cottonwood, are attached to a bunch of fine cotton that serves as a buoy to bear them up through the air, by means of which they are frequently carried many miles from the parent tree. Seeds are often disseminated through animal agency. Animals frequently carry seeds and nuts away and bury them for winter food, where they are forgotten and left to grow.

Many seeds of fruits are swallowed by birds and carried to distant places and voided uninjured, and there spring up and grow. Thus the seeds of cherries, grapes, gooseberries, blackberries, and many others of like nature, are sown broadcast over a large extent of country. During an invasion of the Rocky Mountain locusts into Iowa a few years ago, they left the ground where they fed thickly strewn with the seeds of some species of grass, new to that locality, which they had brought from the far Northwest. Many seeds are provided with hooked barbs, by which they cling to clothing and the coats of animals, and are carried about from place to place.

Many people are familiar with the cockle-bur, the Spanish needle, the "beggar lice," and burdock, and how tenaciously they adhere to any surface where they can get a hold. To this we may add the sand-bur (*Cenchrus tribuloides*), with its sharp spines, one of the most execrable weeds I have made the acquaintance of. Some seeds, as of the maple, ash, elm, etc., are furnished with a wing that causes them to sail off some distance in falling. The locust, Judas tree, or redbud, and others, have a light pad that will often sail off to a considerable distance, thus scattering their seeds.

Some kinds of bean have the pod so arranged that when it bursts it suddenly twists into a coil, throwing the seeds a considerable distance. This habit in the *Impatiens*, or touch-me-not, geranium, etc., is well known. The squirting cucumber (*Momordica elaterium*), when ripe, bursts with a considerable report, throwing its seeds many feet.

A few plants, when their seeds are ripe, travel over the country and sow them themselves. A good example of this kind is the "tumble-weed," about the true name of which the doctors disagree. Two species grow here, the larger, which is the tumble-weed here, grows in a thick cluster of very slender branches, and these so numerous that the bunch, which is often as big as a hogshead, can scarcely be seen through. When ripe they are torn from the roots by the wind, and then they roll and tumble, often with the speed of a race horse, till they meet an obstruction that they cannot surmount, and there they rest till the wind changes, and then they start again; and this is kept up till they are worn out and broken to pieces. Their seeds are thus scattered over all the country.

A plant that grows on the deserts of Africa, the Rose of Jericho (*Anastatica heirochuntica*), when ripe, curls into a ball, becomes detached from the soil and rolls about before the wind till a light shower of rain falls, when it opens its seed pods and drops its seeds, which germinate in about eighteen hours. The wisdom

of the arrangement here is seen when we remember that if it remained where it grew the whole plant would probably be covered by the drifting sands, and that if its seeds did not germinate quickly, while the transient moisture lasted, they never could grow at all. Thus does nature care for her children.

—*The Gardener's Monthly.*

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# GEOGRAPHY.

## THE BENEFITS OF ARCTIC EXPLORATION.

BY THE REV. J. T. HEADLEY, AUTHOR OF WASHINGTON AND HIS GENERALS; NAPOLEON AND HIS MARSHALS, ETC.

Columbus, in his daring attempt to reach the East Indies by sailing west, struck the American continent, and after feeling his way along the isthmus of Darien, gave it up in despair. But the efforts to reach it in that direction did not cease with other explorers, who finding at last that there was no break in the continent, determined to sail around it. Cape Horn, the southern extremity, presented no advantages over the route by the cape of Good Hope, and hence the attention of the commercial world became concentrated on the northwest passage. From Hudson in 1609, to Franklin in the present century, both of whom left their bones amid the ice fields of the north, all endeavors to find this passage proved fruitless. And when the problem was finally solved by McClune, and it was proved that our continent terminated on the north, just below the eighteenth parallel of latitude, and that the ocean stretched thence unbroken to the pole, it was also determined that for all practical purposes, the discovery was useless.

This being settled, there arose a great desire to reach the pole itself, and see what state of things existed there. The declaration of Capt. Symms that a vast aperture was there, increased the curiosity of navigators, for it surrounded this solitude with still greater mystery, and hence naturally intensified the desire to reach it. Whether it will end, like the search for Eldorado or the fountain of life, in blank disappointment, remains to be seen. The fact that Prof. Maury believes there is an open polar sea, where *the whales have their nursery*, that Agassiz also believes it probable, and says that the discovery of a passage into it would be one of the most important results for the improvement of *whale fishing*, and the declaration of Kane, that one of his crew actually saw it, has deepened the interest in this mysterious part of the globe. The land on our planet seems to hang down like great stalactites from the arctic circle into the southern ocean that is believed to stretch in one vast field of ice from the antarctic to the pole.

No one takes any interest in the southern pole. No conjecture is wasted as to whether an open polar sea exists there, and no attempts are made to reach it. True,

Captain Wilkes was sent to explore it; but how serious and persistent was the effort, may be inferred from the fact that the margin of that frozen ocean which he skirted day after day, only to meet the same solid unbroken line of ice, proved afterward to be no more impenetrable than a bank of fog. Straight over the parallel that he said bounded this unbroken field of ice, ships have since sailed for days directly south, without meeting with any obstruction. No effort is made to reach it, and it is in a double sense "left out in the cold." It is taken for granted that there is neither land nor open polar sea there, nothing of any value to the explorer nor the man of science, and all the interest is gathered around the north pole, and all efforts directed thither. This perhaps is not strange, for the south pole seems outside of human interests, bears no part in human activity, while the north pole is intimately linked with man's destiny. Every time his eye rests on the compass his thoughts travel thither. That compass is man's friend, and to the mariner one without which he would drift hopelessly on the sea. No matter how wild the storm and fierce the waves, its tremulous finger points steadily to the pole. A breath may disturb its delicate vibrations, but it comes faithfully back to its daily and mean trusts, to its faithfulness, as if it were divine. The heavens may be wrapped in darkness, and inpenetrable night surround the mariner, his ship may be whirled about by the hurricane and drift on unknown tides and mysterious currents, yet when his eye rests on the slender, steadfast finger, as the light in the binnacle falls on it, he guides his mighty vessel by its silent index with unfaltering trust. It is voiceless, yet over the roar of the storm and the waves it speaks to man in a language that he understands. Thus the north pole is so completely interwoven with man's interest and destiny, that it is not surprising it should occupy so much of hls thoughts. Great efforts and sacrifices have been made to reach it, man has steadily pushed his adventurous efforts farther and farther north, till he has reached a point only some four hundred miles distant from it. When one plan or road is found to have insurmountable obstacles, another is tried, and both hemispheres are to day making or about to make new efforts to solve the mystery of the north pole. It is not our purpose to speak of the various expeditions that have been set on foot, nor of the last one at this time locked up in those frozen regions. The civilization, enterprise and commerce of the world have been on the Atlantic shores of both continents, hence all exploring expeditions to the north have been started and pushed forward by way of the Atlantic ocean instead of the Pacific. Most have endeavored to pass northward through Davis Straits in which they have been compelled to stem a strong southern current bearing downward immense fields of ice. But San Francisco has furnished a base of operations on the Pacific coast from which the Bennett expedition sailed to attempt a passage through Behring's Straits through which a strong current runs north, and that evidently sweeps around the northern limit of the continent, as branches of trees have passed up the e straits from the Pacific and been found afterward coming down Davis Strait. What mysterious law governs this mighty current, and whether it empties into an open sea to pour again south into the At-

lantic, we may never know. The Bennett expedition, entering this great northern current, may burst at length into an open polar sea. If no such sea exists, it may never return to enlighten us respecting this mighty sweep of the ocean around our continent.

The Howgate expedition, as it is called, is based on an entirely new plan, and embraces all the elements of success, if success is possible. Two things have been clearly demonstrated by experience—first, that the arctic winters are as variable as those in warmer latitudes, and hence bays and channels that one year are impenetrably locked in ice, may the next year furnish free passage to ships—second, that in the same season, owing to hidden currents or prevailing winds, channels are opened that admit of a passage to vesesls, which in a short time after, are again closed. Thence, it is plain that a vessel fitted out with every appliance may not reach the arctic regions in a year most unfavorable to any exploration, and the next year may be like it, and so the whole thing prove a failure. Again, a vessel may reach the ice barrier after the only favorable moment for pushing north has passed. Against both these contingencies Captain Howgate's plan provides a remedy. He proposes to establish a colony of hardy men in Discovery bay, provided with everything necessary, so that in any year that the ice opens to them a channel, the expedition may push north, and if there ever does come a time when the polar sea may be reached by a vessel it can be seized. The same may be said of an expedition that should try and reach the same point by sledges. The winter and the times and the opportunity, if they ever do occur, are theirs. Hence we say, whether other expeditions succeed or fail, this plan will succeed, if success is possible. Some nation will have the honor of unveiling the mystery that hangs round it, we have no doubt, and it would be a pity to have American enterprise which has accomplished so much at last outstripped.

It is often asked, why sacrifice so much life and money in these vain attempts to reach the pole? as though curiosity alone or the ambition of the explorer was the ruling motive, and no permanent good was to be accomplished The same question was asked when search was made for Dr. Livingstone in Africa, but behold what future possibilities both to the commercial and Christian world have been opened by it. If there is a polar sea, which scientific men declare probable, and explorers assert they have seen, what islands may dot its surface, or shores fringe it, teeming with new forms of animal and vegetable life! What new light it may throw on the currents of the ocean! It may prove something more than the nursery for whales: *the great fountain head of the electricity that fills our atmosphere—the grand reservoir of that mysterious magnetic force that pervades earth, air and sea, nay apparently spirit itself.* At the furthest point north man has yet reached, still north of him the nightly heavens are flooded with these strange electric tides that seem but the mere overflowing of a boundless sea in which the very universe seems to float. Who knows but man may yet stand at the pole, and there discuss the laws that govern this invisible, mysterious power that seems to inclose and govern all other physical laws. It is not presumptuous to suppose that, when

instead of gazing from afar on the dazzling corruscations that illuminate half the hemisphere, he shall stand in the very midst of those magnetic splendors, he will be able to tell us more than we now know, not merely of their birth-place, but the secret source of their origin. It is not necessary to speak of the new minerals so invaluable to the industrial arts, found nowhere but in the polar regions, or of the fossils that may throw light on the race that formerly undoubtedly inhabited these now waste frozen spaces, and which according to Esquimau tradition still live far to the north of them. It is useless to mention all the advantages to science that these explorations may secure—one thing is certain, if there is an open polar sea, it is impossible to estimate the value of the results that will follow its discovery.

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# GEOGRAPHICAL NOTES.

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## MERIDIAN OF PARIS.

A member of the French Bureau des Longitudes has completed one of the greatest scientific operations of modern times. The meridian of Paris, the imaginary line from which all the French scientific calculations start, passes through the Shetland Islands, Scotland, England, the Channel, and is connected by calculation with trigonometrical points determined in Algeria. The possibility of its extension southward had already been suggested seventy years ago by Arago and Biot, but the difficulties appeared too great to be overcome. A curious circumstance, however, led Commandant Perier to resume the ideas of his illustrious predecessors. In 1868 he was occupied in Algeria in some geodesic operations in the Atlas Mountains, to the south of Nemours, when one day he perceived with the naked eye the profile of the Sierra Nevada, in the province of Granada, Spain, so plainly that he could determine by calculation the position of the two summits Tatica and Mulhocen, about 3,000 meters high. He at once drew up a scheme, which was approved by the Academy of Science in 1872, and the preliminary operations were commenced in 1878. In 1879 the French commission, under the direction of M. Perier, began its work, while a Spanish commission on its side assisted in the Peninsula. The result of these combined labors and calculations is that at present the meridian of Paris is extended across the African continent to the Sahara. The arc thus measured is thirty-two degrees, the largest which has ever been actually measured. The extreme accuracy required in all the data necessitated proofs by every possible means—observations of the visible terrestrial points, the position of the sun, and innumerable observations of the stars, necessitating calculations absolutely bewildering, but which have resulted in fixing beyond doubt the line of the meridian of Paris.

XUM

## ANOTHER NORTHEAST ARCTIC EXPEDITION.

In a letter to M. Sibiarakoff, Professor Nordenksjöld expresses his intention of undertaking another voyage to the northern coast of Asia as soon as circumstances permit. "After my return," he says, "I think of spending a year in preparing an account of the voyage of the Vega, and it is my desire then to continue the exploration of the icy ocean along the coast of Siberia, making the River Lena the point of departure, and the New Siberian Isles the basis of operations. For the object I have proposed to myself—namely, the rendering of the northern part of Asia completely accessible to commercial shipping—the prosecution of these researches is a paramount importance."

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## AFRICAN EXPLORATION.

### THE ABBÉ DEBAIZE'S FRENCH EXPEDITION.

News has been received from the Abbé Debaize, who started about six months ago from Zanzibar. He stopped some time at Lake Nouami in order to accustom his men to the feverish climate. On October 17 he reached Tabora, whence he struck into central Africa, above the point at which Stanley crossed, his object being to discover something entirely new and to reveal the secret of the blank that exists in the middle of the most modern maps. In his report to the Minister of Public Instruction, the Abbé Debaize states, under the date of October 17, that hitherto his mission had been lucky, and that not one of the hundred men in his caravan had deserted. The Abbé himself had been in good health all along, and had managed to preserve his baggage intact. The Chambers voted 100,000f for this mission.

### AN INTERNATIONAL ASSOCIATION.

For many years France, Germany, Austria, Italy, Belgium and Switzerland have had their own geographical societies, and have engaged in the business of African exploration with considerable zeal. But there was no unity, no concert of action, and consequently much money and many valuable services were simply squandered. The French and German travelers sometimes undertook the same problem at the same time; the Austrians and Italians did the same. At last, in 1876, the happy thought of international coöperation and economical division of labor and application of funds occurred to several leading geographers of continental Europe, and this idea was elaborated so far and so successfully that an International Association for the Exploration of Africa was fully and effectively organized, and met at Brussels under the intelligent and distinguished presidency of the King of the Belgians. In this association all the leading nations of Europe were represented except Great Britain, and a branch society was set up in the United States, under Mr. Latrobe's presidency, with Mr. H. S. Sanford (late United States Minister to Belgium) and Mr. Schiffelin, of New York, delegates of

the society in Europe. The organization of the society was very complete and rational. Local geographical societies became branches of the International, which directed movements and disbursed funds. These local societies have two classes of members—those who pay annual dues, ranging from $2 to $5, and those who purchase life memberships at an average of about $100 each. The life membership fund is to be permanently invested. The interest received and the annual dues are applied to the fitting out and support of exploring expeditions. Another part of the society's work, which is most effective and which promises in the end to do a great deal toward opening up Africa to travelers and trade, is the provision agreed upon and put in force for establishing stations or depots at important points on the great routes, where travelers may be received and obtain supplies at their cost. These depots, of which a good number have already been equipped, are to be furnished with goods, provisions, medicines, arms, instruments, etc. They are to be in charge of Europeans, with a native staff, and the person in charge is to increase in every possible way his knowledge of the surrounding and adjacent country and its resources, etc. The Italian government has for years maintained such a station on the frontiers of Abyssinia, and other stations have been founded between Bagamorgo and Ujiji, and at Nyangwe, on the Lualaba. The geographical, ethnological and commercial knowledge to be gathered up in this way will be very extensive and of the utmost importance. Already the reports from the stations embody a vast amount of information.

### ELEPHANTS AS AN AID TO EXPLORATION.

The International Association has practically solved the greatest difficulty in the way of the African problem—namely, that of transportation. Hitherto it has taken travelers many months and cost them great sums to get from the coast to the interior. The bite of the tsetze fly, which infests all the tropical regions of Africa, is fatal to the horse, the mule, the donkey and the ox. Consequently, all goods have had to be carried on the heads of porters, who could not carry as a rule more than fifty to seventy-five pounds apiece, who had to be fed and paid, and who were insolent, disorderly, unreliable, and sure to desert just when their services were most needed. As the only currency of central Africa is beads and calico, it took an immense corps of attendants to enable the traveler to get up from the coast, and the more porters the more mouths to feed and the greater the cost of the expedition. The International Society has, however, substituted Indian elephants for porters, and the experiment has succeeded wonderfully. In a letter from Brussels of the date of October 17, 1879, speaking of the progress made by MM. Popelin and Vanden Heuvel, of the Belgian branch, and of the successful passage of the Mahata, we are told that Mr. Carter's elephants joined the explorers in good condition at Mpwapwa. "The elephants, laden with about one thousand pounds apiece, succeeded in crossing the mountains, swimming the rivers and traversing the swamps and ravines. Contrary to the opinion generally received, they were able to dispense with bread, and to subsist on such provender

as the country furnished. They journeyed across the districts infested with the tsetze, the bite of which, as is known, is mortal to horses, cattle and asses. Literally covered with these insects, they did not seem to suffer even annoyance." Another letter of still later date says: "It remains to inform you, sir, that the elephants have so far perfectly sustained all the fatigues and all the privations to which they have been exposed. They braved the Marenga-Ukali; they have remained forty-two hours without water, and thirty-one hours without food, marching twenty-seven hours laden with more than a thousand pounds apiece."

This is conclusive, and it would seem that as soon as the trasportation problem is solved, the complete opening up of Africa to commerce is only a question of time. That continent is very rich in all sorts of vegetable and mineral resources; it has a large population, and all the civilized world is interested not only in finding new markets for their goods, but new fields to which emigrants may go in search of a living.

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## AUSTRALIAN EXPLORATION.

The Australian government sent out Mr. Forrest in charge of a party, early last year, to explore the Fitzroy River to its source, and afterward the northwest coast to Port Darwin. The expedition consisted of eight men, six Europeans and two natives, with twenty-six horses and provisions sufficient to last six months. The party left Perth on the 18th of January of last year, going by boat to the northern settlement of the colony, from which a start was made, the point of departure being latitude 20° south and longitude 119° east. Mr. Forrest proceeded along the coast, exploring Beagle Bay and King's Sound, and from this traveled through well grassed and well watered but very rough country, to the basin of the Fitzroy River.

This river, at its mouth, is a magnificent body of water, nearly half a mile wide, with numerous lagoons and small lakes along its banks, covered in every direction with water fowl, and the river itself abounding in fish of every description. The explorer could not imagine any better country for settlement, nor one better suited for agricultural and pastoral purposes. It was impossible to cross the river at this point without a raft or boats, and, as the object of the expedition was exploration, the party kept the southern bank of the river without finding a fording place for 250 miles. At this distance a precipitous range of mountains, more than two thousand feet high, abutted upon the river and formed a bar over which they were able to cross.

Up to this point the banks on both sides consisted of plain, open country, covered with luxuriant vegetation, stretching for thirty or forty miles before the usual fringe of blue ranges rose to the view, while lagoons were observed here and there, and tributary streams flowing into the main river at short intervals left nothing to be desired in the way of water. Ships of average tonnage could sail or steam up the river for 100 miles without meeting any interruption.

Above this crossing point the river appeared to flow through high ranges which the horses could not scale, and Mr. Forrest returned thence to the coast, which he reached at Camden Harbor, or the mouth of the Glenelg River. At one time this had been a settlement and a pearl fishery station, but has been abandoned for some years. Finding that the coast was too rough for traveling, he determined to cross the high ranges to the eastward and continue along the table land to the Northern Territory. In this scheme he had more difficulties to encounter than he anticipated.

The ranges were not very high, but very rugged, and for 300 miles they seemed to be without a break, saddle or pass. In every direction they presented a precipitous face. Crag rose above crag, and in the attempt to pass through the rocks the horses were sometimes so closely jammed that it was impossible to extricate them. By this means and by hard journeyings, ten horses out of the twenty-six were killed. The men besides suffered severely from the heat, which was intensified by the reflection from the rocks. One day Mr. M. Forrest, the brother of the leader, had a sudden attack of sunstroke, and as he appeared to be falling, Mr. A. Forrest ran to hold him up, when both rolled together fully thirty feet from rock to rock down to a level spot below, and fortunately escaped with only a few bruises.

After a fortnight spent in a fruitless attempt to cross this range, the project was abandoned and the party returned to the Fitzroy River, keeping about twenty miles south of their former track, and traveling through a level, grassy country.

They found an eastern branch flowing into the main stream in latitude 18° south, and this they followed up to the dividing range in longitude 127° 40′ east. From this point to the boundary of the two colonies, in longitude 129°, Mr. Forrest represents the country as all that the most enthusiastic squatter could desire. Boundless, open, undulating country, covered with tall gaasses, intersected with innumerable rivulets from permanent springs, with here and there large lagoons covered with water fowl, and, at distances of eight or ten miles, large rivers moving slowly toward the ocean. There was no forest observable, except on the immediate banks of the creeks and rivers. For all this, there was one disadvantage —the fever season was now on, and malaria reigned in this district. Several of the men were laid up, provisions were running short, horses had to be killed for food, and, under the circumstances, it was resolved to abandon further exploration and proceed in a direct line to the telegraph wire passing from Port Darwin to Adelaide.

September 19 they arrived at the Katherine station, 240 miles from Port Darwin, alive and well and in excellent spirits, having been exactly nine months in the bush.

Mr. Forrest estimates that he explored upward of 20,000,000 acres of country, well grassed and well watered, and highly adapted for pasturing sheep, horses and cattle, while the plains along the banks of the rivers were suited for the cultivation of sugar cane.

Along the coast hundreds of natives were encountered, armed with spears and other weapons, but they were at all times friendly, and brought the explorers fish and game. In the interior the natives kept at a distance, but the numerous bush fires showed their proximity. They had evidently come previously in contact with the white man, and knew the wisdom of keeping out of rifle range.

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## ARCTIC LITERATURE.

Two interesting works on past arctic expeditions have recently been published. One is a record of Prof. Nordenskjöld's Earlier Expedition, compiled by Alexander Leslie, of Aberdeen, Scotland, and published by MacMillan & Co., in one handsome octavo volume of 440 pages, with numerous illustrations and charts. The other is a record of our own Capt. Hall's Second Arctic Expedition, edited by Prof. Nourse, of the Navy Department, and issued from the Government Printing Office, in a large volume uniform with the Report on the Polaris, and, like that work, profusely illustrated. Two of the charts are especially noticeable, showing graphically the amount of arctic work done during the present century, and the route followed by each of the numerous expeditions engaged. Copious extracts will be made from each of these volumes in succeeding issues of the REVIEW.

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# CORRESPONDENCE.

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## EGYPTIAN CORRESPONDENCE.

ALEXANDRIA, EGYPT, December 29, 1879.

DEAR SIR:—The winter season is again upon us and we are having our usual quota of invalids and sight-seers, a goodly number of whom come from the land of the dear old stars and stripes. We have Captain Eads, of Mississippi jetties fame, General Noyes, our American Minister at Paris, and many others. About our largest export business this winter promises to be "Cleopatra's Needle." Capt. Gorringe and Mr. Davis and assistants are here to take it away to the New Yorkers, to have them wonder *what it is*. Well, it is *not* alive, as it has stood here a matter of some centuries This obelisk is one of the two that originally stood at Heliopolis, and it was brought here to Alexandria in the reign of Tiberius, A.D. 14, and set up in front of the temple of Cæsar, or the "Cæsarium," which the Alexandrians of that day had erected in honor of the emperor. Another account indeed assigns the erection of this temple to Cleopatra to commemorate the birth of a son by her to Julius Cæsar, and, if this story were true, it would explain the origin of the traditional name; but most authorities unite in saying that the former

account is true, and that Cleopatra had nothing to do with this monolith. It is of red granite, from Syene, is about 70 feet high, and the diameter at the base is 7 feet 7 inches. It was standing, until a few days ago, on the sea-shore of what is known here as the New Port, amid a lot of stones, sand and rubbish, and utterly neglected. In appearance it is a poor, wretched, battered out old stone. The hieroglyphics once carved on it are greatly worn, and on one side, mostly are obliterated by the exposure to the sea air, and, except by those who are enthusiastic about such curiosities, it would be considered unworthy of removal. It was entirely neglected by the people here, yet, when they found it was given away to New York, they got greatly excited over it, and petitions were circulated and extensively signed to the Egyptian government to prevent its removal; but what had been promised must be given, so the efforts to stop its removal were useless. After some difficulty, the stone was overturned about ten days ago, and is now being lowered at the rate of twenty inches a day into a wooden boat to be built around it, and, when down and boxed up, is to be launched and towed around to the Old Port, where it will be shoved into the steamer Dussuk, which the contractors have bought of the Egyptian government for £5,100. It is hoped to have it in the steamer and ready to start to New York by the middle of February, but the wise ones here say it is not so easy to move such an immense weight; so don't look for it much before the summer—in time for it to *celebrate the Fourth.*

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Turning aside from business for a moment, with a promise to write again, let us say a few words to the invalid and broken down man of business of America about this wonderful climate. The bane of the climate of eastern North America is, without doubt, its sudden changes, and all your doctors will advise you to search for that much-to-be-desired place, not cold nor warm, but where the temperature will remain constant; and we state, without fear of contradiction, that Egypt is the only country in the world that has so steady and constant a temperature. All during the long summer months it stood constantly at 80° F., with a constant, cool breeze that made it feel like 70° F. at home. Sometimes we would look at the thermometer and shake it, and say, "Surely, it must be wrong." No; there it would stick, morning, noon and night, at 80°, and not budge a hair's line. And later on it went gradually down, down to 70°; then to 65°, and kept to that for weeks; and to-day, and for days back, it is still at 65°, at noon, and 60° night and morning. It has never been below 56°, and that only for a few hours; so that expressions like "rainy," foggy," "frosty," and "dull" are never known in the Egyptian vocabulary, for we have no rain to speak of, nor fog, nor frost, nor dullness. So Egypt, for the sojourner in quest of health, or seeking a change for an overworked mind, cannot be equaled. To find that he can enjoy daily a cloudless sky and the open air, and under the most favorable circumstances, is a cure in itself. Besides, we have pleasant, cheerful cities, that are every year assuming a more and more European look, yet still have the attractions of the Oriental life and the curious costumes of the natives. We are but three days, by

splendid steamers, from Brindisi, Italy, and but five days from Marseilles, France, which is but twelve hours' rail from Paris. Yours truly, L.

—*Correspondence Boston Journal of Commerce.*

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# METALLURGY.

## UTILIZATION OF BLAST-FURNACE SLAG.

Of all the waste substances for which modern science has found a practical use, none could well seem more hopeless than the slag from blast furnaces employed in the smelting of iron. It was even more unpromising than the "tar" of the gas manufactories, which has been so often cited as a striking instance of the utilization of a waste product long regarded as a nuisance, to be got rid of only with much labor and expense. In the iron districts of Great Britain this slag has been accumulating at the rate of millions of tons every year. Hundreds of acres of land have been sacrificed as dumping ground for it, and in some localities the iron-masters have been at their wits' end to find more room for the purpose. In a few cases, as at Barrow, it has been possible to tip it into the sea, and thus make new land; and on the Tees some six hundred thousand tons a year have been absorbed in breakwaters for improving the navigation of the river. But, as a rule, the slag has been an elephant on the hands of the manufacturers, bulky and costly to dispose of.

Now, however, several industrial uses have been discovered for this *bete noire* of the furnace proprietors. An inventor, named Wood, has succeeded in converting the slag into sand, as it is run from the blast furnace. From this sand, mixed with a certain portion of selenitic lime, he manufactures bricks, which possess many advantages over the ordinary bricks of commerce, and are gradually finding a market for constructive purposes. Mr. Wood likewise utilizes this slag sand in the manufacture of concrete, cement and mortar. The works at Middlesbrough, where the manufactures are carried on, are constructed of this concrete, and speak well for the new material. By reducing the slag to a fibrous condition, Mr. Wood has also produced a material which is usefully employed as a non-conductor of heat in clothing steam pipes and boilers. This substance, which has been named "slag wool," or "silicate cotton," from the resemblance it bears to cotton-wool, is perhaps the most striking result of his investigations.

Another direction in which slag is being utilized is the manufacture of glass bottles, and the glass railway sleepers, to which reference has already been made in the *Journal*. To Mr. Bashley Britten commerce is indebted for the first-named development of glass manufacture, and there are works in Northamptonshire where the slag of the iron ores of that county is now being converted into glass bottles, which are said to be superior to the ordinary flint bottles for strength.

The glass sleepers are toughened, as we have before stated, by a new process, the invention of Mr. Frederick Siemens, of Dresden. Some of them have been lately laid on the North Metropolitan Tramway system at Stratford, where they are subject to exceptionally heavy traffic, and have thus far stood remarkably well.

The most recent advance in slag utilization has been made by Mr. Frederick Ransome, in producing a pure white cement of greater strength than the best Portland cement.

A wide field is opened for turning all these inventions to account; and the progress of science and the fertility of invention will probably lead to yet further developments in the same direction. The supply of raw material is not likely to give out, as the present production of slag in Great Britain is estimated at eight millions of tons yearly, to say nothing of the immense "mines" of it to be found in the accumulations of past ages.—*Boston Journal of Chemistry.*

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## COLORADO GOLD AND SILVER PRODUCTION IN 1879.

A special telegram to the New York *Times* gives the production of Colorado by counties as follows:

"Lake County, $11,477,046; Gilpin, $2,608,055; Clear Creek, $1,912,410; Boulder, $800,000; Custer, $720,000; Park, $434,749; Gunnison, $300,000; Summit, $295,717; Chaffee, $71,240; San Juan country, $483,500. Total, $19,110,882. In 1878, it was $9,820,743.12, showing an increase in one year of $9,290,118.88. Lake County shows the enormous increase of $8,759,665.99. Clear Creek and Park counties are the only ones which do not show an increase. While speaking of the Leadville yield, it may be stated that the total of ores treated by smelters for the year 1879 is 110,483 tons, realizing $10,504 106, or a value in pure silver and metallic lead of $95 per ton. This is certainly the largest average value of silver ores in bulk and the greatest production ever known in any camp of its age in the world's history of silver mining. The gold product of the Harrison smelters, amounting to $12,940, has not been included in the above table. This increases the commercial value of the product to $10,517,046. The 21,349 tons of bullion have, therefore, an average value per ton of $492.62½. For the 365 days of the year, the daily consumption of ore by our smelting establishments has been 305 tons, producing 58½ tons of bullion each twenty-four hours.

"The numerous producing mines have much ore on hand, and all the milling establishments carry stocks which, by the most painstaking and conservative estimates, are reckoned at 12,000 tons, at an average value of $90 per ton. This must be added to the smelting product to show the gross mining outputs in ore and the value in dollars for 1879, reaching a grand total of 122,483 tons of ore mined out of the ground, and representing a value of $11,477,046. The ore mined during the year has at no time exceeded 700 tons daily, and has occasion-

ally fallen as low as 150 tons per day. The average for each of the 365 days of the year has been a little over 335½ tons, worth $93.73 per ton."

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The Leadville *Chronicle* says that it is stated that Mr. W. H. Stevens is now negotiating with Flood, Mackay & Co., the Pacific coast bonanza kings, for the sale of his half interest in the Iron mine, Mr. Stevens' price being $880,000 cash. Flood, Fair and Mackay are undoubtedly prepared to transfer their capital and energies to the Colorado mining field, but we do not believe that they will here repeat the history of their operations on the coast.

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## SCIENTIFIC MISCELLANY.

### THE TAY BRIDGE.

This bridge, which broke down on the evening of the 28th of December, and precipitated a train of the North British Railway into the river below, was one of the most important engineering works in Great Britain. It was commenced in 1871, and finished in 1877, in the face of unusual difficulties, by Sir Thomas Bouch. It comprises eighty-five spans, and has a total length of 10,321 feet (or nearly two miles). The reports of the disaster to the bridge, given in the daily papers, state that twelve spans gave way and dropped into the river. The cause of the accident has not yet been ascertained with certainty, opinions being divided as to whether the broken portion of the bridge was carried away by the hurricane that was raging at the time before the train entered upon it, or whether it broke under the load of the train. The legal investigation of the accident, which is to take place, will, no doubt, ascertain the true state of the facts. Meantime, it will be of interest to notice that the official test of the structure, which was made before it was opened to traffic, was pronounced to be entirely satisfactory by the best authority in the United Kingdom. *Engineering* spoke of it as follows:

"The result (of the official test) is the complete establishment of this fact, so important to the public, that the bridge is strong out of all proportion to its possible necessities. As a matter of fact, the load which the structure is calculated to carry is six times greater than that to which it was subjected by General Hutchison."

The constructor of the bridge is reported to have stated, as his opinion after an inspection, that the accident could only be accounted for on the supposition that the train ran off the track, and thus tore the structure to pieces. A thorough investigation of the cause of this grievous disaster is rendered the more imperative, as another bridge of the same kind has been contemplated over the Frith of Forth.

## THE DUKE OF ARGYLE ON AMERICAN SCENERY.

The Duke of Argyle, who is publishing his impressions of America in *Frazer's Magazine*, steps gracefully out of the line followed by ordinary tourists in portraying the beauty and grandeur of Niagara Falls. He is too much of a scientist not to take in the scientific aspects of that magnificent bit of scenery. Its geology is succinctly but not pedantically reviewed, and he fully subscribes to the orthodox geological belief that the gorge below the falls has been cut by the action of the cataract itself, which has receded from Queenstown to its present position. He explains why this particular gorge should be considered as the work of the mighty torrent now flowing through it, while the rule that streams have excavated their own beds is not generally admissible. He dips gently into the hackneyed question of the time necessary for the execution of such an amount of work by such an agent, and concludes that the time when the cataract started from Queenstown was, geologically, not very ancient. In all this he follows substantially, though with a pleasing personality, in the track of other scientific visitors to the falls.

But he was informed that from Brock's Monument, at Queenstown, there was a "fine view," and, proceeding to verify this information by a visit to that historic locality, he found, as he says, a fine view indeed. As his eye swept over the scene before him, his æsthetic nature asserted itself, and he surrendered himself entirely to the enjoyment of what he describes as one of the most impressive landscapes he ever beheld. He remarks that the rivers of America are so large that they resemble lakes without their placidity, and that its lakes are so large that they resemble the ocean without its grandeur. But here, from the high bluffs at the head of Lake Ontario, was spread before him a landscape in which these features were so displayed as to efface their ordinary incomprehensibility. Straight before him the blue water of the lake stretched to the horizon, forming a sky-liner To the right and left, the American and Canadian shores trended away until lost in the blue distance, while the spire of many a neat village, shooting up from amid massive clusters of foliage, lent an additional charm to the superb natural beauties of the scene. To the left was presented one of those great reaches of country, which his eye was able to grasp as a whole, and rob of its oppressive immensity. So far, he shows a fine appreciation of the beautiful; but the æsthetic has its scientific side, and he saw also the lanscape's possibilities.

Up at the head of the gorge, the Niagara is pouring its ceaseless volume down into a recess where the effect is lost because of the contracted field from which it can be viewed. The grandeur of the fall is in a measure estimated instead of felt. The water disappears, but whither can only be ascertained by peering over the banks which confine it. But when the falls were at Queenstown, tumbling out boldly from the bluffs of the lake, their effect must have been grand and beautiful beyond anything which we can now conceive. Instead of plunging into the bowels of the earth, as it were, they flashed out into the pre-glacial sunlight, a salient instead of a hidden feature of nature. The landscape was a setting every

way worthy of such a gem; and what a wonderful charm such a gem must have lent to the landscape. The great cataract, which is now perceptible only in detail, was then visible as a whole from every conceivable point of view. Not only in the shadow of its own mist, but afar off on the bosom of the great lake its effect could be studied.

The Duke, we believe, is the first one to grasp the superiority of the original cataract of its present representative. Tourists of every shade of culture have studied the falls at their leisure, and if there was anything which had come to be taken for granted, it was that nothing new could be written about them. Yet here is a man, writing *currente calamo*, who presents their former superior glory so naturally that it is a wonder no one ever thought of it before. The "fine view" from Brock's Monument is now transformed into a landscape, over which the future tourist may gaze and mournfully reflect that he lives at least forty thousand years too late. The comparatively unevolved man of four hundred centuries ago saw a Niagara of which the present is but a feeble imitation. What a great pity the rocks of the Queenstown bluffs were not gifted with an imperishability that would have preserved the ancient cataract unimpaired. But, since that was impossible, what a pity that the Duke of Argyle has made known to us such a great misfortune.—*Globe-Democrat.*

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## THE WIND EXPOSURE OF BRIDGES.

Mr. Gilkes, one of the engineers of the Tay bridge, estimates—in a paper on the structure, published in 1876—that the wind surface of the span was 800 square feet, that of the truss 800 feet more, and that of a train 800 feet in addition. An experienced bridge constructor in St. Louis informs us that an American bridge of 245 feet span exposes 9½ square feet to the running foot, or 2,327 square feet per span, and that the wind surface of a train is 10 square feet per running foot, or 2,450 square feet per span of 245 feet. Here, then, we have a wind surface of 4,777 square feet, or three times that calculated by Mr. Gilkes; and, as American bridges are more skeleton-like than the English, it is certain that the real wind surface of the Tay bridge was rather more than less than this. But, assuming that the wind snrface exposed was the same as that of an American bridge of the same length of span, we have, at thirty pounds of wind pressure per square foot, a force of 143,100 pounds, acting with a leverage of 98 feet in the effort to overturn span and pier. The upward force, therefore, at the point of junction of the brick and iron piers would be, when combined with the wind pressure on the pier itself, 538,000 pounds, as against a downward weight of half the span, train and pier—417,000 pounds, or 121,000 pounds of tension in the windward column. If this column was of cast-iron, we need go no further to find the cause of the accident. A force of 30 pounds per square foot has been assumed because 31 pounds per square foot will overturn a passenger train.

Nor is the Tay bridge singular in this special weakness. Out of twenty-three

bridges illustrated in *Humber's Iron Bridge Construction*, there are only four that have any wind bracing whatever. These are English bridges. In America in the last ten years there have been blown down no less than four important structures- First, eleven spans of 255 feet each of the bridge over the Susquehanna, at Havre de Grace; next, two spans of 160 feet each at Decatur, Alabama; next, two spans of 250 feet each over the Missouri at Omaha; and, lastly, three spans of the bridge on the Wabash road at Meredosia. All of these accidents were due to weakness of portal and wind-bracing, and the country is full of bridges which are equally defective, and which will fall when exposed to the same forces.

These accidents have borne good fruit. For instance, the bridge specifications of the Chicago, Milwaukee and St. Paul, and those of the Cincinnati Southern Railroad, which are the most stringent yet adopted by engineers, require that all structures shall be proportioned to stand a wind stress of thirty pounds per square foot on both the train and all exposed surfaces of both trusses of the span on which it stands. This is making a commencement toward curing the evil. The old practice was to consider only *one truss* as the exposed surface, and this is evidently still the English custom, as is shown by the method adopted by Mr. Gilkes in computing the wind surface of the Tay bridge.

Evidently there is ample work for the proper officials of the various railroads in making a thorough examination of their bridges built prior to the last three years, and having the wind-bracing of these structures brought up to the proper standard.

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## THE NAVAL OBSERVATORY LIGHT.

For some years the officers of the Naval Observatory, at Washington, have suffered very seriously from the malarial influences arising from the Potomac River, which runs at the base of the hill on which this astronomical institution now stands. The present site is invested with many historic associations. It was here that Braddock, when leaving Alexandria, landed his troops to take up the march for the fatal field of the Monongahela, in 1755, and it was a project of Washington's to establish here a National University, and in 1813 and 1814, during the British invasion, the American army was encamped here. On these accounts, the site has been maintained, but the changed physical conditions of the Potomac River now render the place so absolutely uninhabitable that Congress, after several years' persistent effort, has come to the conclusion that another location should at once be selected, and, instead of passing a measure directing some committee to select a new site and report to Congress, as heretofore, the present bill authorizes the appointment of a commission of three persons, one from each of the naval committees of Congress, and the third to be selected by the Superintendent of the Naval Observatory. Seventy-five thousand dollars is appropriated for the selection and purchase of a site. The rank of the Naval Observatory now stands on an equality with the famous observatories of Greenwich, Paris

and St. Petersburg. The astronomical observations of the last few years, especially that of the transit of Venus, have contributed to give this institution a high position in the scientific world.

## THE ORIGIN AND DESTRUCTION OF THE WORLD.

Prof. Rudolph Falb, a distinguished scientist and savant of Vienna, Austria, recently delivered a learned discourse on the Origin and Destruction of the World. The lecture was altogether scientific, and was couched in the nost recondite and technical phraseology of science.

Beginning his subject, he propounded the following ten questions and propositions, which formed the substance of his discourse and were analyzed in detail: 1. What was the beginning of all things? 2. The sun is the mother of the earth; all the planets were born out of the sun millions of years before this 3. How the elements producing light in the sun and stars are discovered. 4. Origin of the sun. 5. How the starry world is built. 6. The moon originated from the earth. 7. The interior of the sun. 8: What would be the consequence of the sun and moon approaching the earth? Is it possible for comets to come in contact with the earth? and, if so, what would be the result? 9. Will the world be destroyed by fire, water or drouth? 10. How scientists and astronomers anticipate what the end of the earth will be.

Taking up each question, the lecturer explained and answered them in minute detail, following up the origin of all things, the world, sun and stars, as by fire, and their duration to the end of the universe and all things that exist, animate and inanimate. The Professor believed that the earth would be destroyed by fire, and that every atom would separately form the nucleus of a new world.

## ARCHÆOLOGICAL DISCOVERIES IN CLAY COUNTY, MISSOURI.

Mr. F. W. Putnam remarked on the character of the shell-heaps of the Atlantic and Pacific coasts of North America, comparing them with Japan, and alluded to the importance of a comparative study of the shell-heaps in various parts of the world. He then stated that it would be of interest to the members, in connection with the discovery of dolmens in Japan, as described by Professor Morse, to know that within twenty-four hours there had been received at the Peabody Museum a small collection of articles taken from rude dolmens (or chambered barrows, as they would be called in England), recently opened by Mr. E. Curtiss, who is now engaged, under his direction, in exploring for the Peabody Museum.

These chambered mounds are situated in the eastern part of Clay County, Missouri, and form a large group on both sides of the Missouri River. The chambers are, in the three opened by Mr. Curtiss, about eight feet square, and

from four and a half to five feet high, each chamber having a passage-way several feet in length and two in width, leading from the southern side, and opening on the edge of the mound formed by covering the chamber and passage-way with earth. The walls of the chambered passages were about two feet thick, vertical, and well made of stones, which were evenly laid without clay or mortar of any kind. The top of one of the chambers had a covering of large flat rocks, but the others seem to have been closed over with wood. The chambers were filled with clay, which had been burnt, and appeared as if it had fallen in from above. The inside walls of the chambers also showed signs of fire. Under the burnt clay, in each chamber, were found the remains of several human skeletons, all of which had been burnt to such an extent as to leave but small fragments of the bones, which were mixed with the ashes and charcoal. Mr. Curtiss thought that in one chamber he found the remains of five skeletons, and in another thirteen. With these skeletons there were a few flint implements and minute fragments of vessels of clay.

A large mound near the chambered mounds was also opened, but in this no chambers were found. Neither had the bodies been burnt. This proved remarkably rich in large flint implements, and also contained well made pottery and a peculiar "gorget" of red stone. The connection of the people who placed the ashes of their dead in the stone chambers with those who buried their dead in the earth mounds, is, of course, yet to be determined.—*From the Proceedings of the Boston Society of Natural History, Vol. XX, Oct. 15, 1879.*

## UNDERGROUND TELEGRAPHS IN FRANCE.

M Cochery, the Minister of Posts and Telegraphs in France, recently applied to the government for a credit of 8,000,000f for the establishment of subterranean telegraph wires along some of the main trunk lines, to take the place of the existing aërial lines, should the latter become incapacitated by the weather, or by any other cause. The total length it is proposed at present to lay is 295 kilometres.

## A STORM DETECTOR.

Professor A. Mayer, of the Stevens Institute, U.S., records that while a thunder storm was raging at so great distance off that only the illumination of the clouds told when a flash occurred, he attached one wire of a galvanometer to the water-pipes and the other to the gas-pipes of his house, thus connecting in metallic current a vast system of metallic conductors stretching all over the city. Whenever a flash occurred, he states that the galvanometer needle was deflected ten to twenty degrees. The two occurrences were simultaneous, so far as could be determined. The storm was twelve miles distant, and the conclusion drawn was that "at least 500 square miles of the earth's surface had its electrical condition changed at each flash of the lightning."—*Telegraphic Journal.*

## THE RED SPOTS ON JUPITER.

Recent communications to the *Astronomische Nachrichten* give further interesting details of the large, oblong red spot, which may at present be seen on the southern portion of Jupiter's disc. According to Th. Bredechin, of Moscow, it is 16 seconds of arc long and 4 seconds broad, and lies about 9 seconds south of Jupiter's equator. It is surrounded with very brilliant white faculæ, which are especially conspicuous on its southern border.

According to Dr. Lohse, who has observed the spot since last June, it appears to lose, in a considerable degree, its intensity and color when near the planet's limb. He also sees the faculæ, spoken of abo - and remarks at the preceding end of the spot a sort of grayish continuation, resembling in form an inverted comma.

This spot has not apparently diminished in intensity or size during many months—a fact which indicates considerable stability. As there is considerable probability that it will be visible another season, Dr. Lohse suggests that observations of its position will afford very valuable data for an accurate determination of Jupiter's rotation period. The sharpness of outline and regularity of form of the spot admirably adapt it for this purpose. The position of the spot should be fixed by estimation, its distance from the planet's limb being expressed in parts of the parallel of latitude passing through the spot; that is, in parts of the chord of the planet's disc drawn through the spot parallel to Jupiter's equator. Either end of the spot may be used for this purpose. The estimation made when the spot is near the center of the disc will be manifestly the most certain.

This is an opportunity that amateurs should not neglect, since the observation can be made with moderate telescopes and without a micrometer.

—*Science Observer.*

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## ENGLISH WEATHER FOR 1879.

Since the great storms that carried death and destruction into almost every section of the British Islands, between the 27th of December and January 2, the English newspapers teem with meteorological tables and articles, all of which go to prove that our friends on the other side of the Atlantic have passed through one of the most disastrous agricultural seasons ever experienced. Comparisons have been made as to the rainfall of 1869 with that of sixty-four years back, and it was found that during the first nine months of the past year no less than 29 inches of rain fell, while the nearest approach to that amount was in 1828, and then it was 2.5 inches short. During the quarter ending with September, rain fell in 53 out of 78 days, the total amount being 11.75 inches. In April, May and June rain fell almost constantly, and the sun was but rarely seen. The month of July was the most remarkable on record, rain falling every day during the first half of the month, turning to snow in some districts on the 4th, 8th and 9th. August brought

a change for the better, and agriculturists began to think their misery was over. They were doomed to disappointment, however, for, although the middle of the month was all that they could desire, a sudden change took place toward the latter end, and at its close all hope of saving even a moderate harvest was blasted. September was not remarkable for its fine weather. No rain fell during the first week, but the month was in every way similar to the preceding ones. The people have one consolation in learning from the scientists that have examined into the matter that they are very unlikely to experience a recurrence of such a dismal season for many years to come, for, as the tables of averages show, there is a gradual improvement of the climate of England in respect to temperature, notwithstanding the want of warmth that marked 1879.

## RECENT OBSERVATIONS OF THE SUN'S SURFACE.

Observations made by M. Henry, at Perlermo and Rome, during the second quarter of last year, indicate a certain increase in the activity of the solar surface over the first quarter, in the greater number and size of the spots and protuberances. There is also a difference in the relative distribution of the protuberances, which, during the second quarter, were nearly equally distributed over the northern and southern hemisphere, while in the first quarter, on the contrary, they were nearly all situated on the northern hemisphere. During the second quarter the maximum frequency in each hemisphere was between the parallels 30° and 50°, with none at the poles. This distribution is similar to that which prevailed during the first nine months of 1878. In the last quarter of 1878 and the first quarter of 1879, however, many more protuberances were observed in the northern than in the southern hemisphere. M. Henry considers this phenomenon as characteristic of the minimum of solar activity. The maximum frequency of faculæ appears to lie between 10° and 30° in each hemisphere.

M. Henry thinks his observations show that the minimum of solar activity was passed about the beginning of last year.—*Science Observer.*

## THE ELECTRIC LIGHT AT THE BRITISH MUSEUM.

The reading-room of the British Museum is now lighted by electric lamps, and London journals give enthusiastic accounts of the new method. The following is from *Iron*, just received:

"The practical utility of electric lighting was fairly tested on Saturday morning, during the heavy fog which shrouded the metropolis. For more than a century readers at the British Museum have been compelled to suspend work on the occasion of a fog, and to leave the reading-room. But on Saturday morning, shortly after ten o'clock, when many readers, unmindful of the improvements of the age, were about to quit with their papers, the electric light was turned on, and,

without any apparent preparations, the spacious room was suddenly illuminated as by a magic ray of sunshine, to the great satisfaction of all present. There was a murmur of applause. For, with the new carbon which Messrs. Siemens have manufactured at their Berlin works, and with the gilt reflectors suggested by Mr. Bond, the principal librarian, the light is about as good a substitute for sunlight as can yet be desired.

"Since the latter part of October, the electric light has been continuously used in the national reading-room of an evening until seven o'clock, and an average of more than two hundred students and literary men have been nightly able to proceed with their researches to that hour, instead of leaving off, as formerly, when the shades of evening fell. It is reported that one of the staff, Mr. Nichols, has worked closely two hours daily for a fortnight by the light, with a view to try the effect on the sight, and finds that there is not only no inconvenience, but that the optic nerve is strengthened and that glasses are quite unnecessary as a protection."

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## THE ELECTRIC LIGHT IN THE GERMAN ARMY AND NAVY.

The *Year-Book for the German Army and Marine* states that the electric light has been empl yed for military and naval purposes—among others, for lighting up the ground lying in front of a besieged fortress, for the illumination of ships at sea, and, notably, for carrying on work under water. A transparent bell with an electric lamp has been immersed to a depth of 60 meters, while a magnetic electrical machine, placed at a distance of 100 meters, has been able to maintain a strong, unbroken current, so that a brilliant light was maintained for a long time. The same authority states that experiments are now in course of being carried out for the purpose of testing how far the electic light can be usefully employed in marine warfare, and especially as a defense against torpedo attacks.

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## HOW SMELTING IS DONE IN LEADVILLE.

The methods of obtaining the precious metals contained in ores can, in general terms, be classified into two—one crushing and amalgamating, an operation called milling; the other, the fusing of the entire mass of ore and separation of the pay from the slag and iron by operations depending upon the specific gravity of each. The former method is the one applied to gold ores altogether, and to such silver rock as is wanting the presence of lead, a production of nature that—ignoring the metallurgical terms in existence, which are seldom used—destroys the effect that quicksilver has upon silver and gold in separating it from the rock after crushing has freed it. Milling is the process used in the treatment of the quartz found in the Comstock lode, but some of the Comstock ores require a preliminary introduction to a roasting or matting furnace, and, in some instances, demand the

presence of chemicals before they will release their hold upon other mineral affinities to accept the embraces of the quicksilver.

Smelting has long been in use in iron works in Missouri and New York, and in pig lead manufactories at Lake Superior, Utah and other less noted points, and suggested the idea to silver mine owners, who had found that the long used milling process was without effect.

The ores of Leadville are noted for three qualities seldom seen traveling hand in hand—very rich mineral, mined with ease unprecedented, and reduced at a trifling expense compared with smelting in other localities. The *modus operandi* in use here can be made clear by a description of either one of the numerous extensive works now in operation.

The fusion of the rock is the same in every establishment, but the many details attending the movement of the rock and appurtenances looking toward convenience are brought to varying degrees of perfection in different works. The furnaces in use are what are known as "water jackets." The floor of the stack is constructed of cement, clay, and material calculated to prevent the seepage of the mineral into the ground. The "water jacket" is constructed of very heavy iron, and has a diameter of probably five feet and a height of six feet. Within this the molten metal separates according to specific gravity. The iron jacket is kept from succumbing to the terrible heat by the continual circulation of water between the inner and outer plates that compose it.

Upon one side, and having a connection with the molten mass near the bottom of the furnace, is the lead well, or place from which the bullion is dipped into iron moulds. The pressure of the charges above forces the bullion into the well, keeping it full at all times; but care must be exercised lest so much be dipped out that the slag will assume its place. In ordinary works two front spouts are used, one for iron—the lower one – and the other for slag; but, owing to the ease with which Leadville ores are separated, only the latter is here used, both iron and slag being drawn from it.

Resting upon the "water jacket," and supported by pillars, a brick flue, of a foot or more larger diameter, extends for twenty-five feet, when it converges until an ordinary sized smoke-stack is reached. Each fire has a blower which fans it through five tueres, two on each side and one behind.

The prime element conducive to success is a proper mixture of ores; that is, some mineral contains sufficient lead to fuse but lacks the iron necessary to flux it, no one rock, as a general thing, containing all the ingredients arranged in proper quantities. Hence the demand for good judgment and experience on the part of the purchaser. Oftentimes a price in advance of the amount that can be taken from the rock is paid to secure one ore carrying the factor needed to assist in smelting another class.

In the same manner the quantity and sort of fuel must be regulated from experiments in the laboratory and from practical workings of the furnace. The feeder's is the responsible position, as, although another brain plans the ingredients of

the charge, and other hands mix it, upon him rests the duty of properly distributing it in the furnace and at the proper time. His position is one subject to the great evil in smelting—getting "leaded"—and the good wages he receives are well earned by the danger he is constantly incurring.

A furnace is run night and day. To allow it to cool down, would entail a heavy expense in drilling out the mass of iron and slag that would have to be removed. Charcoal and coke are the only fuels used, the latter being obtained principally from the east at an expense of about sixty dollars per ton, and the former is worth eighteen cents per bushel.

The bullion, as shipped, contains about four hundred ounces of silver to the ton, and each furnace yields from six to ten tons per day, the result of from twelve to twenty tons of ore.—*Carbonate Chronicle.*

## PENETRATIVE POWER OF THE ELECTRIC LIGHT.

Some time ago an experiment was made in New York State to test the distance at which the electric light would illuminate a given spot, and it was found that a concentrated beam carried seven miles furnished enough light to read by. A more crucial test of the great penetrating power of the electric light is furnished by the experiments of the officers of the French Algerian Triangulation Service, who recently saw the electric light from the Spanish station of Zetica, from a distance of more than 164 miles. This observation is proof, if proof were wanted, of the great value of the light for maritime purposes, when it is exhibited from sufficiently elevated positions.

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In a lecture delivered at Berlin, on Electricity in Service of Life, Dr. Werner-Siemens spoke of the problem of electric transmission of power to a distance. He stated that two cases of the kind existed in the city. In one case looms were driven, and in the other a small locomotive. He also insisted upon the value of electricity for metallurgical purposes, and thought that the solar rays may by-and-by furnish all necessary fuel through the agency of the electric current.

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Palmetto fiber, it is now said, makes an excellent article of paper, and machinery has been set up at Fernandina, Fla., for experimental purposes in this line.

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Robin has confirmed, by new experiments, his discovery that the electric organ in the tail of the ray acts like that of the torpedo and gymnotus, the differences being merely of a secondary nature.

A glass manufactory in Hanover, Germany, makes glass which is a close imitation of marble, and tables and floor tiles which are pronounced preferable to marble on account of their extreme hardness.

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Dr. Tellef Dahll has isolated a new metal from a sample of copper-nickel, and calls it "Norwegium." It is white, with a brownish tinge, and in hardness resembles copper. The melting point is 350 degrees centigrade, and specific gravity 9,441.

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# BOOK NOTICES.

THE PHILOSOPHY OF THE SCIENCES. By J. M. Long, A.M. Chillicothe, Missouri; 1879.

The author of the above named work is Professor of Physiology in Richmond College, Missouri, a man of learning and culture, who has had the courage to undertake, not only the writing, but the publication of a Classified Scheme of Knowledge, arranged especially with reference to "right methods of instruction." The work is not yet completed, but we have been favored in advance with a few pages, which sufficiently indicate the general object and course of the writer. Part I is devoted to Preliminaries; Part II to Categories of Sciences, *i. e.*, Quantity, Motion, Force, Organism, Mind, and Being; Part III, Statement and Application of Organizing Law, as to Cosmology, Andrology, and Ontology, with Bearing on Right Methods of Instruction.

As illustrative of the author's style and the ground-plan of the work, we quote briefly:

"The entire body of Science constitutes an Organism, in which all the related parts exert a reciprocal influence on one another. All the branches of Science are so mutually dependent that one part cannot advance without the advancement, to a certain extent, of all the others. This reciprocal influence is shown in two ways, in *data* and *method*. The entire history of Science furnishes illustrations. Thus terrestrial mechanics furnished the data for celestial mechanics, while this reacted on the former by embracing its phenomena in the universal law of cosmical space. The concept of force as manifested in the interactions of masses has unfolded into the higher conception of the interaction of molecules, and thence by a still higher unfoldment into the all-pervading *ether*, the sole function of which is motion. Molecular physics has furnished important data to chemistry, while both these sciences have united to raise physiology to the rank of a science. Biology has also furnished important data to Sociology, the science of human society. So intimate is the relation between these two sciences that the study of socio-

logical problems, independently of the data furnished in Biology, would be antiquated and far out of the range of the best thought on this subject. Sometimes one science furnishes important data to another in the form of analogies"

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THE PROFESSIONAL SCHOOL IN THE AMERICAN UNIVERSITY. By Thomas Jefferson Lowry, S.M., N.G., C.E. Columbia, Missouri, 1879.

The above is the title of a very full and exhaustive lecture delivered by Prof. Lowry at the University of Missouri. Its object is to advocate the claims of Industrial Education in the State, and it covers the ground very comprehensively. We shall probably use portions of this excellent lecture for the benefit of the readers of the REVIEW in our next issue.

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DOUBLE STAR OBSERVATIONS. By Sherburne Wesley Burnham, M.A. Chicago, 167 pp. quarto.

This work, and the necessarily vast amount of labor involved in taking the observations, making the calculations and recording them, give a strikiug illustration of what untiring industry, combined with natural fondness for a subject, can accomplish; for, as we are informed, Mr. Burnham is by profession a lawyer, and only makes Astronomy a recreation. His chosen department is that of double stars, and the volume under consideration comprises a list of hundreds of such double stars, discoved, measured and described by him in 1877–78. It is reprinted from Vol. XLIV of the Memoirs of the Royal Astronomical Society. The observations were made with the 18½-inch refractor of the Dearborn Observatory, which, when constructed, was the largest object-glass in the world. Prof. Burnham describes several simple but effective improvements made by himself for the handling of the instrument, reading of the vernier of the right ascension circle, etc. His indifference to the luxuries of some observers is characteristic. We note his remarks on the manner of observing:

"The Observatory is provided with no seat or couch for zenith observations. * * * For moderate altidudes I have used a step-ladder, making a tolerably comfortable seat by the simple expedient of placing a box on the step below, equal in height to the distance between the successive steps."

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CHEMICAL HISTORY OF THE SIX DAYS OF CREATION. By John Phin, C.E. New York, 96 pp. 12mo; 50c.

This is a chemical history of the creation of the world, and is an attempt to reconcile the Mosaic cosmogony with that indicated by modern science, from the chemist's standpoint. The author claims for it that his theory "accords so wonderfully with the Mosaic account that it is at least impossible to say that in this matter science is in the slightest degree opposed to revelation."

Besides giving chemical proofs and illustrations in support of his theory, the author in several instances has strayed into other departments of science, but in

each instance it is for the benefit of the general reader. It is a very satisfactory little book indeed.

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LETTERS FROM EUROPE. By Hon. W. D. Kelley. Philadelphia, 1879, Porter & Coates.

This pamphlet comprises six letters, written by the distinguished writer and statesman to the Philadelphia *Times*, during the summer of 1879, with notes since added. The principal object of the publication is to "shed light upon the question of bi-metallism, a question of grave and world-wide importance." But at the same time Mr. Kelly has succeeded in rendering it particularly interesting to the general reader by his remarks upon the eminent personages he met and the notable places he visited. His eminently practical turn of mind and utilitarianism have led him out of the ordinary track of traveling letter writers, and the result is a small volume of facts, observations and conclusions worthy of being preserved in any public or private library.

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## OTHER PUBLICATIONS RECEIVED.

We have received from Prof. Ormond Stone, of the Cincinnati Observatory, a chapter from the *American Journal of Mathematics*, Vol. II, 1879, entitled On the Dynamics of a Curved Ball, in which he points out and corrects an error made by Prof. Eddy in his paper on The Lateral Deviation of Spherical Projectiles.

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Report of the Proceedings of the Thirteenth Annual Session of the Missouri Press Association, held at Columbia, Mo., May, 1879.—Atti della Societa Toscana di Scienze Naturali Residente in Pisa, Processi Verbali, Vol. II; Pisa, 1879.—Annual Statement of Live Stock Receipts and Shipments at the Kansas City Stock Yards; by E. E. Richardson, Secretary.—Inter-Oceanic Canal, by Prof. J. Lawrence Smith, Louisville, Ky.—American Entomologist, by Profs. C. V. Riley and A. S. Fuller, New York.—The Caterer, by J. Gilbert Smith, London, England.—The President's annual address to the Missouri Medical Association, May, 1879, by Prof. E. W. Schauffler, M. D.—How to learn Short-Hand, by Arthur M. Baker, S. R. Wells & Co., N. Y., 25c.

XUM

# EDITORIAL NOTES.

THE lecture of Prof. J. T. Lovewell, of Washburn College, Topeka, upon Some Lessons from the Life of Faraday, delivered before the Kansas City Academy of Science, on the 13th ult., was an able, interesting and instructive discourse. The average attendance upon such lectures may be regarded as a fair test of the intelligence and literary tastes of any community.

The next lecture of this extra course will be delivered by Prof. F. E. Nipher, of Washington University, St. Louis, on the evening of Tuesday, February 17.

The regular meeting of the Academy was held at its rooms on the evening of the last Tuesday last month. Papers were read by Messrs. Coddington and Gilham, the first upon the Relation of Æsthetics to Industry, and the second upon Sanitary Engineering. Both of these papers were received with great favor and will be published in future numbers of the REVIEW. A general invitation to attend these meetings is extended to all, without charge.

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IN the death of Hon. Alfred Gray, which occurred on January 22, the State of Kansas loses one of her most valued and trusted citizens. During the late war he was one of the foremost in tendering his services, and was an active and efficient officer in the 4th and 5th regiments of Kansas infantry. After its close he was appointed Secretary of the State Board of Agriculture, in which position he labored until his death. He was an excellent citizen and an intelligent, zealous and untiring worker. In our judgment, no one factor has contributed more to the rapid growth and progress of Kansas than the skillfully prepared, comprehensive and exhaustive Reports of the Agricultural and Mineral Resources of the State, prepared and distributed by Mr. Gray.

THE Executive Committee of the Kansas Academy of Science held a meeting on Saturday, the 17th ult., and adopted measures to erect a fitting monument to the late Prof. B. F. Mudge. A committee, composed of Judge F. G. Adams, of Topeka, Joseph Savage, of Lawrence, and Prof. Parker, of this city, was appointed with power to act. Manhattan has pledged one hundred dollars for the monument, and there are hundreds, doubtless, who would delight to honor this public benefactor by contributing to this fund. Col. Theo. S. Case has been appointed to receive subscriptions in Kansas City. As Prof. Mudge was well known to many of our citizens, and was highly esteemed by all, it is hoped that we shall be able to send forward a generous tribute.

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SOME alleged professional wags in Congress took occasion a few weeks since to be witty over the communication in the December REVIEW, from Mr. J. Walter Fewkes, of Cambridge, Massachusetts, relative to the peculiar habits of certain marine crustaceans, and published their efforts in the *Forest and Stream*, of New York, much to its temporary enlivenment. Evidently they have heretofore mistaken their callings.

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THE Kansas State Board of Agriculture, at its annual meeting, re-elected R. W. Jenkins, President, H. C. St. Clair, Vice-President, and Wm. Sims, Treasurer. The Board took action favorable to the holding of a State Fair at Topeka next fall. Prof. Snow was appointed State Geologist; Prof. E. A. Popenoe, Entomologist; Prof. Hawn, of Leavenworth, Meteorologist; Profs. John W. Robeson and J. H. Carruth, Botanists; G. H. Failyer, Chemist, and W. Popenoe, Auditor.

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THE attendance at the University of Missouri is the largest ever known in the history of that institution, and it is successful in all

its departments, everything working in a degree highly satisfactory.

The Board of Curators, at a late meeting, passed a resolution of thanks to President S. S. Laws for his generous contribution of $500, the amount necessary to exchange the present telescope in use at the University for one larger and of a more approved pattern.

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THE December number of the Kansas City REVIEW OF SCIENCE AND INDUSTRY has a very clear description and explanation of the explosion of Corle & Son's candy factory, in Kansas City, Mo., written from the editor's standpoint of investigation in chemistry. It is so clear, reasonable and indisputable, that we make room for the facts as he has elaborated them.

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We really think Mr. Case, the editor of the REVIEW, has done himself credit, and that the subject matter has been treated the most clearly of any that has come to our hand.

—*Boston Journal of Commerce.*

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THE new span of the St. Charles bridge, on the Wabash, St. Louis & Pacific Railroad, has been completed. Trains are now crossing the bridge regularly. The work of rebuilding was accomplished in just one month from the time of the accident.

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DISPATCHES state that on the 9th of January Portland, Oregon, was visited by the most severe storm known since the settlement of that country. The direction of the wind at the commencement of the storm was southwest, but later it veered to the south. But little rain accompanied the storm, though heavy clouds passed overhead during its continuance. The damage to property in the city was not less than $75,000.

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THE KANSAS CITY REVIEW OF SCIENCE AND INDUSTRY comes regularly, and is as regularly read. We again express our high appreciation of its merits. We do not know of a scientific journal that has a more interesting table of contents than Mr. Case sets before his readers each month.—*Farm and Fireside, Dec., '79.*

SOUTHEAST MISSOURI is booming up as a sugar-producing region. Experiments there the past summer with the early amber cane prove that section to be admirably adapted to the production of sugar.

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MR. CALVIN DETRICK for a number of weeks past has been experimenting on the preparation of an artificial fuel, composed of coal culm, and his experiments were of such a satisfactory nature that he has already secured letters patent upon the same. The value of Mr. Detrick's discovery cannot be estimated, for it will, at a small cost per ton, utilize the millions of tons of coal culm, which are now being annually wasted in the preparing of coal for market.

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ADMIRAL AMMEN says of the interoceanic canal routes:

"The Panama route was carefully located at the request of the commission, and a line located at an elevation of 123 feet above the ocean, which will probably require an increase of four or five feet, as shown by the flood of last November. The cost of this route on a common basis for labor and materials with Nicaragua was more than fifty per cent greater, and will, in fact, cost more than double to execute the work.

"The Nicaragua route has in canalization 61¾ miles. The remainder is either lake or slackwater navigation in a river not subject to floods. The water supply is twenty times more than could be used in lockage. The elevation of the summit level of the canal is 107 feet, and that of the divide between the oceans 150 feet. The cost of the canal, as estimated by the civil engineer, without an allowance for contingencies, was $52,000,000, and the cost named by the Commission $100,000,000."

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SINCE the first opening of the Kansas University as a State institution up to the beginning of the present college year, 1,702 students have been enrolled. Since 1873, thirty-three have graduated in the collegiate department. The present year opens with a larger attendance than ever before, the number of students enrolled, up to October 31, being 358.

XUM

WE have received from Prof. F. H. Snow, of the Kansas University, a copious and comprehensive summary of the Meteorology of Kansas for the year 1879, prepared from observations made by himself and Prof. H. S. S. Smith, which will be published in full next month.

THE Topeka Literary and Scientific Club, at its recent annual meeting, elected the following officers for the year 1880: President, Prof. John T. Lovewell; Vice-President, Miss Eunice A. Lyman; Secretary, Geo. S. Chase; Treasurer, J. Lee Knight.

"CANST thou not minister to a *mine* diseased?" is the present query of many a shareholder on the Pacific slope.

PROF. SWALLOW'S lecture upon Evolution and Creation is concluded in this number of the REVIEW, which will be a gratification to those who did not hear it and a relief to those who were misled by the accidental omission of the words "*To be continued*," at the end of that portion published in the January number, and supposed that it was given in full.

## NOTES FROM PERIODICALS.

THE *Journal of the Franklin Institute* commenced its one hundred and ninth volume with the January number, under very favorable auspices, its list of able contributors among scientists and engineers being largely increased and its support being such as to warrant an increased effort and expenditure on the part of the publication committee. As a technological magazine, it is without a rival in the country, while it also contains a large amount of information on the practical applications of science.

AS WE write, *Harper's Monthly*, which has been "new" for over thirty years, comes to hand for February, and, as ever, it brings a fresh and wonderfully entertaining table of contents. There is no periodical published in the world that, in the quality and variety of its articles, the excellence of its illustrations, its general tone, and the manner of its editorial management, equals this as a family necessity.

THE Boston *Literary World* has just been burned out with the Osgoods, but, nevertheless, manages to come out promptly on time and as bright, sparkling and fresh as ever, filled with just critical reviews of all the new books, literary items of all kinds, Shakespearean notes, contents of all the leading periodicals, etc., etc. It is just such a fortnightly visitor as students, public libraries, and teachers need and will enjoy when received.

THE *Science Observer*, edited by G. H. Elson and F. R. Kimball, of Boston, is devoted principally to astronomical articles, but has, during the past two years, given space to a number of very good articles on other subjects of scientific interest. It commences its third volume with the December number, and deserves a large patronage.

WE are as often indebted to the *Scientific American*, and its comprehensive and well edited *Supplement*, for valuable articles reprinted in the REVIEW, as to any other exchange we receive, and we know of no other paper that would replace it in the workshop, the factory or in the household as a chronicler of progress in mechanic arts, manufactures or popular science.

WHAT the leading literary journals of the day are to the reader who wishes to keep abreast of modern progress in education, geography, history, and *belles-lettres*, *Van Nostrand's Magazine* is to experts and proficients in engineering, architecture, mathematics and technical science. Its contributors are among the best writers and most skilled engineers of the country, whether in the army or in civil life, and it ranks with the best periodicals of its class in the world.

*New Remedies*, published by Wm. Wood & Co., and edited by Drs. Castle and Rice, must be one of the most useful publications to the medical profession and trade that is to be found.